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Three dollars a year

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Stewart Products

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Why clutter your shelves with a slow-moving stock when you can handle accessories like these?

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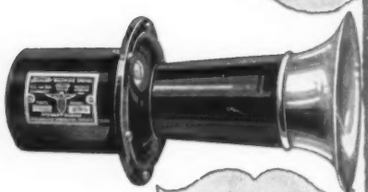

Stewart Motor Driven Warning Signals $6

Stewart Tire Pump $12

Stewart Hand Operated Warning Signal $3.50

Stewart Products
PRESTIGE QUALITY SERVICE SATISFACTION
MADE IN USA

STEWART-WARNER SPEEDOMETER CORP.

Chicago, U. S. A.

Stewart Speedometer $25

Stewart V-Ray Spark Plug $1

Warner Auto-Meter $50

Stewart Vacuum System $10

The AUTOMOBILE

VOL. XXXVI NEW YORK—THURSDAY, JANUARY 25, 1917—CHICAGO NO. 4

Setting the Stage at Chicago

Three Shifts of Workers Busy Building Medieval Castle in Coliseum for Show

CHICAGO, Jan. 23—Preparation of the Coliseum and its adjacent buildings for housing the seventeenth annual car exhibition which opens Saturday presents a more serious problem to manager S. A. Miles and his associates than it has in recent years. The great Allied Bazaar which has been in progress in the mammoth structure, closed last Saturday night and almost before it came to an end workmen invaded the building and started on their work of devastation of the booths and special decorations for the charity function. They have been working continuously in 8-hr. shifts in the transformation of the Coliseum from a street of all nations into an ancient English castle.

Ninety-six automobile manufacturers will exhibit their products. This is larger than the number at New York 2 weeks ago. There will be 165 exhibitors of accessories, making a total of 261 distinct displays.

The Chicago exhibition always is looked upon as more of a business show than is the New York exhibition and it is anticipated that the coming show will surpass former records. Dealers are flocking to the city, hotels are full and show business already is under way. Texas dealers are on their way here in a special train. Four thousand dealers are expected and ticket arrangements for them are the same as they were at the New York exhibition.

The scheme of decoration will be a union of medieval and early English renaissance; and the somber massiveness of the foundation gives an impressive effect. The scenic setting has been designed at a cost variously estimated between $30,000 and $50,000.

Aside from the main attraction at the Coliseum and its three supplementary structures, there will be a number of special displays in place of or in addition to the master exhibit. The Chicago Salon will appear for the second time in the Elizabethan room of the Congress, opening Monday, Jan. 29 and running for the week.

—

Standard Parts Negotiating for Purchase of Western Spring Co.

CLEVELAND, Jan. 23—Negotiations are on for the purchase of the Western Spring & Axle Co. by the Standard Parts Co., recently formed by the consolidation of the Perfection Spring Co. and the Standard Welding Co. The large magnitude of this combination is manifested in the fact that the Western Spring company owns four plants in Michigan and Ohio, including properties such as the Armstrong plant in Flint, the Hess-Pontiac and Cleveland-Canton Spring plants in Canton, and the Hess Spring & Axle Co., Carthage, Ohio.

Christian Girl, president of the Standard Parts Co., states that the deal is still entirely uncertain.

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United Motors Buys Radiator Damper

DETROIT, Jan. 24—The damper used on the Hudson and Columbia cars and owned by the Detroit Motor Appliance Co. has been sold conditionally to the United Motors Co. pending an investigation of the patents. The device is made by the Harrison Radiator Co. through a patent license granted to the Hudson company by the owner. The sale stipulates that the Detroit Motor Appliance Co. may continue to manufacture a damper for use on Ford cars. A subsidiary company will be formed for this purpose.

—

Hastings Vice-President of Hupp

DETROIT, Jan. 22—C. D. Hastings has been made vice-president and general manager of the Hupp Motor Car Corp. Except for the 2 years 1915 and 1916, he has been with the company since its beginning.

Hall Lamp Co. Buys Badger Brass

Plant Sold for $400,000—Yule Retires—$2,000,000 Business for 1917

DETROIT, Jan. 22—The purchase of the Badger Brass Mfg. Co., Kenosha, Wis., by the C. M. Hall Lamp Co., Detroit, was completed on Jan. 20, the Badger plant being sold to the Hall company for approximately $400,000.

The transaction was handled by J. F. Hartz, president of the purchasing company and William F. Anklam, secretary and general manager. The business will be carried on from the central offices at Detroit, Mr. Anklam handling both plants as the general manager and G. A. Mahler working as the manager of the Kenosha factory.

Expect $2,000,000 Business

The consolidation makes the Hall company the largest producer of its kind. Business for the next year for both plants, it is estimated will total more than $2,000,000.

G. A. Yule, president, R. H. Wells, treasurer and C. G. Koch, vice-president of the Badger company retired from that concern on Jan. 20, immediately following its sale.

Badger Name to Be Continued

The Badger Brass Mfg. Co. was organized in 1896 and had a capital stock of $200,000. The name of the firm will be perpetuated by its purchasers. The C. M. Hall Lamp Co. was founded in 1908 and has a capital stock of $750,000. Its officers are J. F. Hartz, president, F. T. Buchanan, vice-president, J. L. McDonell, treasurer, and G. M. Anklam, secretary and general manager. Mr. Anklam, who was active in the purchase, was connected with the Badger company for 10 years prior to his coming to Detroit to form the Hall concern.

Hand Horn Patents in Suit

Piel, Owner of Long Patent, Charges Aufiero Patent Interferes—Claims Priority

NEW YORK, Jan. 20—Gottfried Piel of the G. Piel Co., Long Island City, and owner of the Long hand horn patent, has brought suit against Emanuel Aufiero, charging that patent No. 1,207,834, granted to Aufiero, interferes with the Long patent, which it is claimed has the right of priority.

The suit is one of the unusual types known as interfering patent suits, such a suit being possible only when the patent office has issued two patents claiming the same invention.

To Bring Countersuit

The Aufiero interests state that a countersuit will be brought very soon.

Patent No. 1,090,080, owned by Mr. Piel, was granted March 10, 1914, to George F. Long, the inventor, on an application filed Sept. 30, 1910, and was assigned to Mr. Piel. Mr. Aufiero's patent, No. 1,207,834, was granted Dec. 12, 1916, on an application filed Feb. 20, 1913, as a division of an application filed May 31, 1912. The bill of complaint in the suit lays particular emphasis on claims 7, 8, 9 and 10 of the Long patent and alleges that the Aufiero patent contains as claims 1, 2, 3 and 4 claims in the identical language of 7, 8, 9 and 10 of the Long patent. The Aufiero patent is also alleged to contain other claims which conflict and interfere with the claims of the Long patent.

The complaint declares that Mr. Long conceived and put in practice the invention of his patent and particularly the features covered in claims 7, 8, 9 and 10 long prior to Sept. 30, 1910, the date of application for the patent. It is also stated that horns embodying the invention were put into use by him and his associates before May 31, 1910, and alleges that claims 1, 2, 3 and 4 of the Aufiero patent are void, as the invention they describe was in public use for more than 2 years prior to the date when Aufiero filed the original application of which the application which resulted in the granting of patent No. 1,207,834, "purports to be a division." Long horns were sold by Long and his associates early in the spring of 1911, the bill of complaint states, and it alleges that Aufiero obtained his patent No. 1,207,834 by fraudulent means in that he knew he was not the original inventor of the invention specified in his patent.

Mr. Piel asks for the establishment of title to the invention, the issuance of a preliminary injunction restraining Mr. Aufiero and his associates from assigning right, title or interest in patent No. 1,207,834 without leave of the court, and also for a decree adjudging the Aufiero patent, and particularly claims 1, 2, 3 and 4 thereof, void and directing the proper authorities to cancel the patent and to make the proper entries as to the concellation thereof in the records of the United States patent office.

Long Claims Involved

Claims 7, 8, 9 and 10 of the Long patent are as follows:

7—In a device of the character described, a diaphragm, energy transmitting means, and energy receiving, storing and imparting, means adapted to receive energy from the transmitting means, said second means being always free immediately to transmit said energy to the diaphragm.

8—In an alarm or signalling apparatus, a diaphragm, a wear piece carried by said diaphragm, a rotor adapted to actuate said wear piece to vibrate the diaphragm, said rotor constituting a heavy flywheel having a relatively large mass, and manually actuated means for intermittently energizing said flywheel and vibrating the diaphragm for a period of time extending beyond the period during which energy is applied to said flywheel.

9—In an alarm horn a signalling apparatus, a diaphragm, a rotatable member adapted to vibrate said diaphragm, and actuating means intermittently in operative engagement with said diaphragm vibrating member, said member constituting an energy reservoir having capacity to produce continuous vibration of the diaphragm during intermittent movement of said actuating means of sufficient frequency to generate a continuous note.

10—In a device of the character described, a diaphragm, and means for vibrating the diaphragm, comprising energy transmitting means, and energy receiving and imparting means of large mass receiving the energy from the transmitting means, and adapted to resist the influence of irregularly applied energy and to move with gradually increasing and decreasing velocity.

The suit is in the United States District Court for the Eastern District of New York.

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Pierce-Arrow Raises Car Prices

BUFFALO, Jan. 22—The Pierce-Arrow Motor Car Corp. has increased its prices for 1917. The touring and the 48-roadster model have been increased $500, the model 38-closed body, $700; and the model 48-closed body, $800. This change makes the present price list as follows: 38-models except brougham and landaulet $4,800, brougham and landaulet $5,900; 48-models, roadsters and five-passenger touring car $5,400, seven-passenger touring $5,500, limousine $6,800; 66-model, two and four-passenger roadsters $6,400, seven-passenger touring $6,500, limousine $7,800.

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Simplex Chassis $1,000 Higher

NEW YORK, Jan. 22—Simplex Automobile Co. has increased the price of its chassis $1,000. The chassis now sells for $6,000.

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Amedee Bollee, Sr., Dead

PARIS, Jan. 21—Amedee Bollee, Sr., a brother of Leon, the inventor, known in France as the father of automobilism, is dead. Mr. Bollee was the builder of a steam car in 1873.

Lindsay Axle Not Invention

Court's Reason for Awarding Decision to Winton as Announced Last Week

CINCINNATI, Jan. 22—Lack of invention in the Lindsay axle was the reason given by the United States Sixth Circuit Court of Appeals in deciding in favor of the Winton company, appellant, on Jan. 12, in the case of Winton Motor Carriage Co. vs. Lindsay Auto Parts Co., suit for infringement of Lindsay patent No. 748,760.

The court herein takes direct issue with the opinion of Judge Clarke in the district court, which held that the Lindsay rear axle combination was novel in mode of operation and appearance.

The present hearing was before Circuit Judges Knappen and Denison, and District Judge Cochran. The decision was handed down by Judge Denison.

The court held that the principle of building an axle so that the differential could be easily inspected, and the live axle sections readily withdrawn, was not new; and that the method used by Lindsay exhibited only such skill as was to be expected by one trained in mechanics. It held that the combination had been in the main shown in two earlier patents, one to Lindsay, No. 612,360, and one to Winton, No. 610,466.

—

Percy Martin on English Air Board

NEW YORK, Jan. 18—A signal honor has been conferred on an American who for many years has been one of the leading figures in automobile manufacture in England. Percy Martin, for 12 years managing director of the Daimler company in Coventry, and who was born in U. S. A. has been appointed one of a committee of three men constituting the Air Board, an assembly of business men having full control of all questions, including design, manufacture and supply of aeroplanes for all government purnoses. This Air Board was appointed to solve the long-standing dispute between the army and navy as to which should control questions of design, manufacture and supply of aeroplanes. The Air Board has no control over the use of the aeroplanes once they are furnished to either the army or navy.

—

Houk Director of Buffalo Trade Board

BUFFALO, Jan. 21—George W. Houk has been elected a director of the Buffalo Chamber of Commerce. Mr. Houk is president, general manager and controlling stockholder in the Houk Mfg. Co.

Recommend $10 Fees For Trucks

Committee Favors Hewitt Bill Despite Protests of Owners and Associations

ALBANY, N. Y., Jan. 24—Despite vigorous protests and overwhelming objections by a representative delegation from eleven associations, nine large users and three manufacturers, the joint committee on motor truck taxation of New York State reported favorably the Hewitt bill, which will increase truck and omnibus fees from 10 to 1000 per cent more per year. With only 21 hr. notice a hearing was held from 3 to 5 p. m., and, sitting for but 15 min. afterward, the committee reported favorably on the bill without considering any of the representations of the delegation.

Under the new bill trucks will be charged $10 a ton.

Representatives of the Motor Truck Club of America which called the gathering, of the National Automobile Chamber of Commerce, of the Motor Truck Club of New Jersey, of the Automobile Dealers' Assn. and of similar organizations, unanimously voted to protest against the proposed rates which would increase the fees from double to fourteen times the present charges.

A plea to have a state commission appointed with sufficient funds and power to determine scientifically the relative degrees of road wear as caused by the different types of vehicles will be presented to the state authorities by a committee endorsed by this meeting.

Claims Schedule Illegal

The motion of protest was presented by Joseph Husson, associate editor of *The Commercial Vehicle*, which has been opposing the findings of the special motor truck fee commission. This commission presented a schedule based on gross weight and the seating capacity of buses, whereas the law which created it specified that the tax basis be upon the time use of roads or the wear caused on such roads. The schedule has been opposed as unconstitutional on the theory that a commission has no right to fix taxation. Governor Whitman has coincided in this opinion; and Senate Bill No. 73 with Assembly Bill No. 123 were introduced Jan. 15 to give legal support to the commission's findings.

President Stephens of the Motor Truck Club and seven other members of the organizations represented to-day came to Albany to ask for a hearing.

The proposed tax is burdensome in that trucks are already taxed as personal property up to 2 per cent of their value whereas passenger cars are not, the committee will point out. It will also advise that the large number of horse wagons be taxed, and will contend that the proposed regulation would hinder the most progressive type of road transportation.

The committee will propose that the present charges be continued until the findings of the desired scientific body have been arrived at.

The Motor Truck Club of America is sending out notices to its members which are in the form of a protest to accompany the payment of registration fees on their trucks or omnibuses.

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Ayers Fisk Sales Manager

NEW YORK, Jan. 20—F. H. Ayers has been appointed sales manager of the Fisk Rubber Co., New York, with headquarters at the company's general offices at Chicopee Falls, Mass. Mr. Ayers has been with the Fisk company for many years and was formerly supervisor of districts.

—

Napier Detachable Wire Wheel Patent Invalid

NEW YORK, Jan. 18—There was recently settled in England a long-standing dispute covering the basic patent of a detachable wire wheel, that is a wire wheel in which the wheel can be removed, leaving the hub with its bearings in position on the axle. This patent was for years held by J. S. Napier, formerly of the Arrol-Johnson concern, and who licensed the majority of the wire wheel manufacturers in England. The courts have decided the patents invalid and consequently any person is free to manufacture detachable wire wheels. This decision does not in any wise affect the validity of the many patents covering different methods of attachments as well as locking devices.

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Kepler Briscoe Purchasing Agent

JACKSON, MICH., Jan. 19—H. L. Kepler has been appointed purchasing agent of the Briscoe Motor Corp., this city. Six years ago Mr. Kepler left the National Cash Register Co. with C. A. Woodruff to join the Chalmers organization, where he was associated with Mr. Woodruff as assistant purchasing agent until the present change.

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Willeman Resigns from Briscoe

LANSING, Jan. 20—A. B. Willeman has resigned as superintendent of purchases for the Briscoe Motor Corp., this city.

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Schyler Leaves for Scandinavia

DETROIT, Jan. 20—W. A. Schyler who handles the export business of the Buick Motor Co. and is foreign representative for the General Motors Export Co., left Detroit this week for the Scandinavian countries.

England Stops Car Manufacture

68-Cent Gasoline Restricts Use —Not Over 200 Unsold U. S. A. Cars

NEW YORK, Jan. 17—Joseph A. Mackle, Director of the Willys-Overland, Ltd., London, who for several years past has been an annual visitor at the New York shows arrived in this city to-day too late for the show, due to steamship delays. Mr. Mackle expects to be in the country several weeks and will attend the Chicago show. According to Mr. Mackle, there are not over 200 unsold U. S. A. cars in the British Isles at present. When the complete prohibition order barring importation of passenger cars into England was enforced March 21, there was on hand a 3 months' normal supply of U. S. A. automobiles. Due to government restrictions on gasoline, this 3 months supply proved adequate for 10 months, otherwise the surplus would have been exhausted months ago. At present gasoline is selling at 68 cents per Imperial gallon and each private motorist is given 2 gal. of gasoline a week for his private use. This means approximately 50 miles per week of motoring and because of such the use of cars has been very much restricted.

Under Munitions Director

Beginning with Dec. 15, the government restricted the manufacturing of passenger automobiles in England by English makers. Previous to that time the Ford factory in Manchester and a few other manufacturers were producing passenger cars. Ford was making as high as 200 per week at its Manchester factory. Since Dec. 15 the activities of the Ford and other factories have been restricted to delivery wagons, ambulances, etc.

At present all of the automobile factories are under the direction of the Minister of Munitions and for control purposes he has divided the entire industry into three broad divisions: A, manufacture of passenger cars; B, manufacture of commercial cars; C, automobile repair work. The manufacture of class A has been stopped. A warning order has been issued to proceed more slowly in the manufacture of commercial cars. A recent order limited the amount of any one repair job to $50. If the repair work on a passenger car exceeds this amount a special permit from the government must be obtained. This restriction has been imposed due to conservation of labor.

The extent to which manufacturing has increased in the British Isles may be illustrated by one example. Village X before the war was a straggling hamlet of a few hundred inhabitants. To-day

there are over 20,000 men employed in the manufacture of munitions, and there is one row of munition factories extending over 8 miles. The buildings are not continuous but separated as required in all munition centers.

To date there has been no conscription of labor in the British Isles and no rigid regulation of drink or food. There have been requests for the public to restrain itself in connection with these matters.

Previous to the war there were approximately 4000 dealers and garagemen in the country. Many of these dropped out of business soon after the war and those remaining have been selling U. S. A. cars and trucks. Since the importation of U. S. A. cars has ceased, many London dealers have been using their few lathes on sub-contracts for munition manufacture. London dealers have been doing a big business in buying and selling second-hand cars.

The use of taxicabs has lessened very materially but in spite of 68 cent gasoline, the rate of charge is still 16 cents a mile the same as it has been for years. Taxicabs are in general use in the heart of the city but not used much in the outlying sections. There are still 2000 passenger buses, the majority of which are operating in the more central part of the city. Women drivers are becoming common on taxicabs and light deliverey wagons.

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Batt Is Hess-Bright Sales Manager

PHILADELPHIA, Jan. 22—W. L. Batt has been made sales manager of the Hess-Bright Mfg. Co., this city, and will have entire charge of its sales after Feb. 1. Mr. Batt has been connected with this company since its early days.

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Hutton Director of Timken Purchases

DETROIT, Jan. 22—W. H. H. Hutton, Jr., has been made director of purchases for the Timken Axle Co. The company recently held a stockholders' meeting and re-elected all of its officers with the one exception.

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Hansen Haynes Purchasing Agent

INDIANAPOLIS, Jan. 22—C. I. Hansen, formerly of the purchasing department of the Mitchell-Lewis Motor Co., Racine, Wis., assumed his duties as purchasing agent for the Haynes Automobile Co., Kokomo, Ind., last week, succeeding C. H. Landsittel. Carl Heady will continue to serve as assistant purchasing agent for Haynes.

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Freeman Joins Robbins & Myers

SPRINGFIELD, OHIO, Jan. 19—H. E. Freeman, formerly vice-president of the American Trust & Savings Bank, this city, has been appointed treasurer of the Robbins & Myers Co., this city, makers of electric motors, generators and fans.

70 Per Cent of Crude Oil for Fuel

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Independent Oilmen's Assn. Predicts Common Use of Kerosene Driven Vehicles

WASHINGTON, (*Special Telegram*), Jan. 24—Within 5 years 70 per cent of all crude oil produced above 30 gravity will be converted into fuel, the balance to supply the lubricants necessary to keep the engines and bearings cool, Secretary Grant of the Independent Oilmen's Assn. predicted at the zone convention here today.

Low-grade oils will be successfully used in carbureters much sooner than the general public expects, the society concluded. Commercial vehicles using kerosene as fuel will be in common use, it is believed; but the convention was divided on the practicability of kerosene for passenger cars.

The Independent Oilmen's Assn. went on record to-day as indorsing a discussion of the possibility that the use of kerosene may not only be made more profitable, but that soon it may be made to perform uses now impossible; that, despite improvements in refining conditions, consumption has always a little more than kept pace with them. Within from 3 to 5 years, it was agreed, due principally to the increase in the number of automobiles in use, the price of gasoline will not only be considerably higher than it is, but it will be a difficult matter to obtain the fuel in sufficiently large quantities to supply the demand; natural gas is being condensed in large volume and has demonstrated its usefulness in the satisfactory blending with lower grade products to make a merchantable article; cracking systems and processes have been tried, some proving successful, others unsuccessful, until at the present time barely three or four are considered seriously. The one thing which could solve the problem, but only temporarily, would be the adaptation of kerosene as a satisfactory fuel to internal combustion engines.

Some Practical Devices

Discussing the gasoline problem in connection with the need for the adaptation of kerosene as a satisfactory fuel for internal combustion engines, secretary E. E. Grant, in a report on investigations made by a special sub-committee of the association headed by Judge M. J. Byrne, Waterbury, Conn., Prof. C. E. Lucke and Prof. F. J. Metzger, both of New York, said attention of the committee had been brought to the following makers of kerosene carbureters:

John Good Inventions Co., Brooklyn; Universal Carbureter Co., Cleveland; George Jacobs, Detroit; A. A. Wootton, Eureka, Kan.; Holley Bros., Detroit; Alfred Cohn, Warren, Pa.; Wilcox-Bennett Co., Minneapolis; Kerosene Motor Co., Peoria, Ill.; Dr. A. J. Edwards, Hot Springs, Ark.; and John Rome Battle, Germantown, Pa.

Kerosene appliances: J. W. Meaker, Jr., Evanston; Peter Orance, New York; W. G. Gehrs, Milwaukee; M. B. Hammond, Bridgeport, Conn.; H. A. Gilbert, Brooklyn; Hydro Carbon Converter Co., New York; Chemical Mixtures Collis Co., Clinton, Iowa, and C. A. Whitcomb, Stratham, N. H.

New cracking method: Ellis Foster Co., New Jersey.

The sub-committee finally selected a kerosene carbureter manufactured by Holley Bros., Detroit, and one by John Good, Brooklyn, as, in their opinion, worthy of recommending and pushing, said Secretary Grant. He added, Holley Bros. promised to be ready within 60 days to turn out their carbureters in sufficient quantity to fill orders.

Professors Lucke and Metzger, Geo. P. Brockway, Warren, Pa., L. H. Atkinson, New York, and F. E. Vantilburg, Minneapolis, of the special committee on kerosene carbureters, were not present at the meeting Tuesday night to discuss this proposition, those present including Judge Byrne, T. B. Westgate, Titusville, Pa., T. G. Cooper, Philadelphia, and Secretary Grant.

Thomas H. Prosser and John Good drove from Brooklyn to Washington in Mr. Good's D-45 Buick, equipped with his kerosene carbureter, making the run without a stop on account of carbureter trouble. No gasoline was carried. Mr. Good gave several demonstrations.

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Goodrich Earnings 13% on Common

NEW YORK, Jan. 24—Earnings of the B. F. Goodrich Co. during 1916 were given as amounting to $9,550,000, or about 13 per cent on the common stock, in a preliminary report at the meeting of the board of directors held here to-day. This statement shows $2,715,679 less than 1915 earnings, the drop being due to increased cost of manufacture without corresponding increase in prices.

The directors declared a dividend of 1 per cent on the common stock and also a dividend of 1¾ per cent on the preferred for the next two quarters.

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Two Genolite Lighting Systems

DETROIT, Jan. 22—The Detroit Starter Co. hereafter will sell its Genolite electric lighting system for Fords in two models—Type C at $2,985 and Type D. These systems are the same except that the Type D includes a windshield spotlight with a 7-in. door and a mirror. Type C system includes a generator, storage battery, side lamps, tail lamp and head lamp control. The equipment can be installed in 2 hr. and requires no machine work. One feature of the installation is that it automatically controls the current flowing through the headlamps so that their brilliancy remains constant at all car speeds.

Maxfer Brings Out 1-Ton Truck

Has Worm-Drive, Electric Lighting and Non-Stall Differential—Price $1,195

CHICAGO, Jan. 23—The Maxfer Truck & Tractor Co., which has been making truck forming attachments for Ford cars, is bringing out a new 1-ton truck complete which will be styled the Dependable and will sell for $1,195. The truck is equipped with a four-cylinder, 3½ by 5 in. engine, is worm-driven and has a number of features including electric lighting and starting equipment and a Bailey non-stall differential. The wheelbase is 130 in. and the loading space 4 to 6 ft. wide and 9 to 11 ft. long, according to the type of body. Rear tires are solid pressed-on type 34 by 4. The equipment includes cab curtains and a windshield.

The new truck together with the Maxfer company's "whale for work," the Ford converting unit, will be exhibited at a special showroom directly opposite, the Coliseum at 1512 South Wabash Avenue. During the show the company will make its headquarters at this salesroom. The company will produce 28,000 of its truck units this year and in addition will produce 2000 of the Dependable models. The Chicago plant is being quadrupled in size and in addition there is a plant at Martinsburg, Va.

The Maxfer company will give a dinner at the Chicago Athletic Assn., Jan. 31, for its dealers and salesmen.

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Murray to Head National Rubber

POTTSTOWN, PA., Jan. 20—James A. Murray, vice-president and general manager of the Seamless Rubber Co., New Haven, Conn., will take the presidency and general management of the National Rubber Co., this city, on March 1. Mr. Murray is one of the most widely known men in the rubber industry, having been with the Seamless company 22 years.

Jacob G. Feist, who retires as president of the National company, becomes commercial and sales manager.

—

E. L. Ferguson, Pioneer Tourist, Dies

WASHINGTON, Jan. 19—Ernest Lincoln Ferguson, better known in the automobile field as Fergy, died to-day. Mr. Ferguson was the manager of the local bureau of the American Automobile Assn. He was 51 years old and is survived by a widow and two children.

Mr. Ferguson was a pioneer blazer of trails throughout the country. Since the inception of the automobile he made logging and signmarking highways his life's work. He was the director of several national tours, the Munsey, and the New York-Atlanta. He acted as official starter in the past Glidden Tours and managed a number of automobile contests. At one time he was automobile editor of the New York *Evening Mail* and connected with *Motor Age* when that publication first began.

One of Mr. Ferguson's notable achievements was the piloting of the first merchandise-carrying motor truck from New York to San Francisco.

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Trego Resigns from Knox and Springfield Motors

SPRINGFIELD, MASS., Jan. 19—F. H. Trego has resigned as chief engineer of the Knox Motors Co., and of the Springfield Motors Co., of which he was works manager and a vice-president. He has been succeeded by E. R. Gurney as chief engineer at the Knox plant. Mr. Gurney was formerly in the engineering department, General Electric Co., having been with that company nearly 15 years.

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Raise $100,000 for Factory

FOSTORIA, OHIO, Jan. 23—E. W. and W. O. Allen of the Allen Motor Co. outlined their plans to 300 members of the Chamber of Commerce yesterday. The meeting was for the purpose of raising $100,000 stock subscription for an automobile body plant to be built in addition to a $150,000 automobile factory which the Allen company will build on a 55-acre tract of land recently purchased by that concern. More than $110,000 worth of stock was subscribed for the body plant within 15 minutes.

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Stewart-Warner Earns $2,215,043

CHICAGO, Jan. 24—The Stewart-Warner Speedometer Corp., this city, earned $2,215,043 in the year ending Dec. 31, 1916. This is an increase of $184,423 over 1915, and equivalent to approximately 21½ per cent on the $10,000,000 common stock after payment of dividends on preferred now retired.

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Lamson Truck Adds

CHICAGO, Jan. 22—The Lamson Truck and Tractor Co., formerly known as the Zeitler & Lamson Truck Co., this city, has completed an addition to its plant. Additional space on account of increased business for 1917 will be needed before the expiration of the year. After reorganizing this company decided to enlarge the scope of its business and has entered into a selling campaign for national and international distribution.

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Economy Motor Co. Repudiates Merger

TIFFIN, OHIO, Jan. 24—The Economy Motor Co. has repudiated the merger which had been arranged for with the Bellefontaine Automobile Co. and will soon float an issue of stock to increase its Tiffin plant.

British Tanks Built at Lincoln

High Wall Surrounded Factory—Two Six-Cyl. Daimler Sleeve-Valve Engines

LONDON, ENG., Jan. 6—Much of the secrecy which surrounded the manufacture of the now famous automobile tanks has been dissipated. No war device built in England is kept such a secret as the tanks. They were built at Lincoln where a high wall surrounded the factory. The workmen entered this inclosure and were not permitted to leave it or see their families for a period of 3 months. Each tank is fitted with two six-cylinder Daimler sleeve-valve motors of approximately 150 hp. The tank has four forward speeds, the maximum being 6 m.p.h.

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Paige Orders Increase 300 Per Cent

DETROIT, Jan. 24—The Paige-Detroit Motor Car Co., this city, reports an increase in present orders of 300 per cent over a year ago. At the stockholders meeting it was reported that 39 per cent cash dividends was paid on average capital stock paid in 1916 with a capital stock increase of 108 per cent in value during the same year.

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Springfield Bodies from Detroit Plant in 60 Days

DETROIT, Jan. 24—The Springfield Body Corp. at its annual stockholders' meeting reported that the local plant is 75 per cent completed, and that the corporation would be shipping bodies from its plant within 60 days. The company has licensed thirteen manufacturers to build the Springfield type body on a royalty basis and thirty-two automobile companies have adopted it as standard equipment.

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Sedan Body to Build

UNION CITY, IND., Jan. 24—The Sedan Body Co., this city, will complete its new building in June. The brick structure will be two stories and will have 54,000 sq. ft. floorspace. C. C. Adelsperger is president and general manager and C. C. Koontz is secretary and treasurer. Two hundred men will be employed.

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Houk Mfg. Co. Adds

BUFFALO, Jan. 24—The Houk Mfg. Co., this city, is building an addition to its factory at a cost of $26,000.

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Champion Factory Ready Feb. 1

FULTON, ILL., Jan. 21—Champion Motor Car Co. will start production in its reconstructed factory Feb. 1. The output within 6 weeks from this time will be 270 light delivery cars per week.

Hackett and Gem To Move

Jackson, Mich. and Delaware Companies Will Locate in Grand Rapids

GRAND RAPIDS, MICH., Jan. 22—This city is to have two new automobile manufacturing plants, announcement having been made that the Hackett Motor Car Co., now located in Jackson, Mich., and the Gem Motor Car Co., recently organized under the laws of Delaware, will build here.

At present the Hackett plant gives employment to about 200 men. A $50,000 factory will be erected in this city.

The Gem company was organized about a month ago with an authorized capital of $250,000 of which $150,000 is yet to be issued. The intention of the company is to buy chassis and bodies complete and assemble them here. Some of the parts will be manufactured here. A light four delivery car, capacity 1000 lb., is being assembled in Detroit.

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Over 250 Attend Champion Convention

TOLEDO, Jan. 22—The third annual get-together and banquet of the Champion Spark Plug Co. was held at the factory Jan. 20, the banquet being held at the Toledo Club that evening. More than 250 persons were present. Each year the Champion company runs a train of special cars to its plant, carrying engineers and other officials from the Detroit motor car factories.

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Convention at Packard Plant

DETROIT, Jan. 20—A 2-day convention for dealers and truck sales managers started Friday at the Packard factory. Sales plans for 1917 were discussed. Representatives from fifteen Packard agencies were present.

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Everitt Resigns from Raybestos

BRIDGEPORT, CONN., Jan. 24—Richard Everitt, sales manager of the Raybestos Co., this city, has resigned, effective tomorrow. For the present his assistant, M. S. Judd, will assume his duties.

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Schwartz Wheel to Add

PHILADELPHIA, Jan. 19—The Schwartz Wheel Co., this city, has acquired property about 160 by 200 ft., adjoining its plant, to be used for extensions.

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Durant Interested in Iron Co.

SAGINAW, MICH., Jan. 20—The Saginaw Malleable Iron Co. has been incorporated here with a capital of 350,000 to employ 450 men and to have 12,000 tons capacity. Active operations will begin July 1. Among the principal stockholders is W. C. Durant of the General Motors Co. This industry has been brought to this city through the efforts of G. H. Hannum, general manager of the Jacksor-Church-Wilcox Co., a division of the General Motors Co.; C. F. Drozeski of Chicago and J. B. Kirby of Saginaw. Mr. Drozeski will be the manager of the concern.

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Continental Motors Buys Land

DETROIT, Jan. 20—The Continental Motors Co. has purchased a block of property in this city which now rests in the Continental Realty Co., a concern organized by B. F. Tobin and R. W. Judson, president and vice-president respectively of the Continental Motors Co. The property includes what was known as the Hovey plant on Western Avenue between Third and Fourth Streets.

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Fageol in Production in March

DETROIT, Jan. 23—Production will be started in March on the 2-ton truck designed for the Fageol Motors Co., Oakland, Cal., by Cornelius T. Myers of this city. The 5-ton chassis will embody more of Myers' chassis lubrication principles which were described in THE AUTOMOBILE for Jan. 18, on page 185. The basic idea behind this system of lubrication is the elimination of grease because of its dirt-carrying propensities and the substitution of oil with wick feed.

A factory is being equipped in Oakland, Cal., for the manufacture of these trucks and the Fageol passenger car. Louis Bill, formerly general manager of the Jeffery Co., and Webb Jay of the Stewart Warner Corp. are respectively president and vice-president of the company.

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S-S-E Co. Erects Plant

PHILADELPHIA, Jan. 19—The S-S-E Co. has erected a factory for the construction of the S-S-E car. The plant is located on a 20-acre tract of land at B Street and Erie Avenue, and is 360 by 90 ft., of brick and steel, with overhead prismatic lighting. Machinery is being installed with provision for individual electric drive of each unit in the shops.

The new car will be coming out inside of 4 months, and the company expects to produce 500 in the first year.

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Muzzy-Lyon to Make Aeroplane Parts

DETROIT, Jan. 21—D. W. Rodger of the Muzzy-Lyon Co., Ltd., manufacturers of motor bearings, has completed arrangements with the Duesenberg Motor Co. to furnish it with bearings to be used in the engines it is now building for the government aeroplanes.

Rush Oakland Plant Additions

New Northway Engine Factory Will Double Present Output

PONTIAC, Jan. 20—The Oakland Motor Co. is pushing construction work which will add 5 acres of floorspace to its plant and plans to complete it by Feb. 15. A new engine plant, which will build the Oakland Northway motors and will double the present output by employment of 1200 to 1500 men, is a part of the present expansion. Others include a machine shop, one-story high, 80 ft. by 442 ft., engine assembly, one-story high 80 ft. by 242 ft., engine test, one-story 80 ft. by 242 ft., machine shop office not yet under way, one-story 70 ft. by 137 ft., final assembly, three stories, 93 ft. by 238 ft.

These structures which will have 227,280 sq. ft. of floorspace will increase the total floorspace of the factory to 638,280 sq. ft.

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Over 25,000 Cars Sold in 11 Months

DETROIT, Jan. 22—The Hudson Motor Car Co. sold and delivered 25,000 Super-Sixes in the first 11 months following its introduction to the public.

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Autocar Offers Service Kit

NEW YORK, Jan. 20—One of the most progressive steps ever taken by a motor truck manufacturer to give the owners of its trucks quick and efficient service has just been made by the Autocar Co., Ardmore, Pa., which to-day offered its Autocar service kit. This consists of a trunklike box in which are furnished a selected list of spare parts for Autocars. The parts included in the box are determined by a consideration of the number of such trucks the owner may have and whether he is located 1 mile or many miles away from the nearest Autocar branch, service station or agency.

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Maxwell Assembly in St. Louis

ST. LOUIS, Jan. 23—The Maxwell Motor Sales Corp. has leased 30,000 sq. ft. of floorspace in the plant of the St. Louis Car Co. and will use this for a temporary assembling plant for the Southwest. Testing yard space of 20,500 sq. ft. also has been obtained, and it is stated that the Maxwell company contemplates the erection of a branch factory here.

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Form Standard Electric Mfg. Co.

INDIANAPOLIS, Jan. 22—The Standard Electric Light Co., capitalized at $100,000, has been formed to manufacture an automatic light control device. The in-

vention enables a car owner to set the time when the lights of his machine are to be turned on. The mechanism is not operated by clockwork, but by gravity. The company expects to erect a concrete and steel factory within a year at Indianapolis. The stock is all common, divided into 10,000 shares at $10 per share.

E. C. Applegate is the inventor of product and is chief executive of the company; D. H. Duncan is vice-president; Ralph E. Potts and Frank E. Hall will be in charge of the sales.

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Bethlehem Motor to Build

ALLENTOWN, PA., Jan. 19—The Bethlehem Motor Corp., this city, recently organized, is arranging to erect the initial buildings of its proposed plant for the manufacture of commercial vehicles. The plant will be on property acquired along the New Jersey Central Railroad and will be equipped to produce 2000 trucks the present year.

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Farmer Boy Tractor Plant Inadequate

COLUMBUS, Jan. 20 — The McIntyre Manufacturing Co., this city, maker of the Farmer Boy tractor, has purchased a tract of 12 acres on West Goodale Street upon which will be erected a large factory 100 by 200 ft. The present plant at 127 West Locust Street is too small to take care of the increased demand for tractors. Construction will be started soon.

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Briggs Secures Harroun Contract

DETROIT, Jan. 22—The Briggs Mfg. Co. has contracted with the Harroun Motors Corp. for the assembling and trimming of Harroun bodies, and will use a part of the Prouty & Glass plant at Wayne for that purpose.

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First Shipments of J. & D. Tires

CHARLOTTE, N. C., Jan. 22—Six sizes of tires have been included in the first shipments of the J. & D. Co. to its distributors. The company has limited its production to the more popular sizes, namely: 30 by 3, 30 by 3½, 31 by 4, 33 by 4, 34 by 4, and 36 by 4½.

Freight Congestion To Continue

N. Y. C. President Sees No Immediate Relief in Sight—Asks Cooperation

NEW YORK, Jan. 23—Little hope is held out for quick relief from the freight congestion by the railroads of the country, according to an open letter from A. H. Smith, president of the New York Central Lines, to F. P. McQuade of the American Druggists' Syndicate.

The sudden prosperity and increased production brought upon the railroads a demand for 40 per cent more service in many instances. The roads have not had the reserve to meet this demand and cannot build facilities in a short time. Moreover, the companies are hampered by the greater cost of materials and the shortage of labor.

Cooperation and patience is asked from the public. The big railroads have placed orders for hundreds of engines and cars which will in time relieve the situation. Mr. Smith blames the difficulty in part on the excess amount of Government regulation. He concedes that regulation is necessary, but calls attention to the large number of state and local commissions which supplement the Interstate Commerce Commission and hamper the efficiency of the railroads.

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Drives 75 Cars to Fostoria

LANSING, Jan. 20—A fleet of seventy-five cars left the Reo Motor Car Co. plant yesterday for Fostoria, Ohio. The fleet is being driven to its destination because of freight car congestion. Another trip of similar dimensions will be made next week. The two fleets take the entire output of the Reo company for one day.

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Car Shortage Worse Than Before

DETROIT, Jan. 20—According to J. S. Martin of the National Automobile Chamber of Commerce, who is in this city in an endeavor to relieve freight congestion, the shortage of freight cars for automobiles is worse now than it has ever been in the past and not more than 50 per cent of the required number of cars is being delivered to the factories. Local men place the number at 15 per cent. A meeting of traffic men was held last Thursday and devoted entirely to the collection of data concerning the shortage.

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Embargo Declared in Detroit

DETROIT, Jan. 23—An embargo has been declared on all freight excepting coal, live stock and food products, through the Toledo gateway to Detroit, which it is expected will relieve the serious shortage of coal that is now threatening the Ford Motor Co., the Packard Motor Car Co., and the other automobile manufacturers in this city. At the same time that the embargo lifts the difficulties of coal shortage, it adds to the troubles of car makers insofar as it hinders all shipment of automobiles by way of Toledo.

At this time it is estimated that 14,000 automobile freight cars are needed beyond the present supply, to handle automobile shipments.

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Goodyear School for Deaf Mutes

AKRON, Jan. 21—Deaf mutes in the employ of the Goodyear Tire & Rubber Co. now have the benefit of a special division of the company's factory schools. The chief subjects taught are business arithmetic, English and mechanical drawing. A deaf-mute literary society and athletic teams have been formed. Ashland D. Martin, a deaf-mute graduate of Gallaudet College, is in charge of this work.

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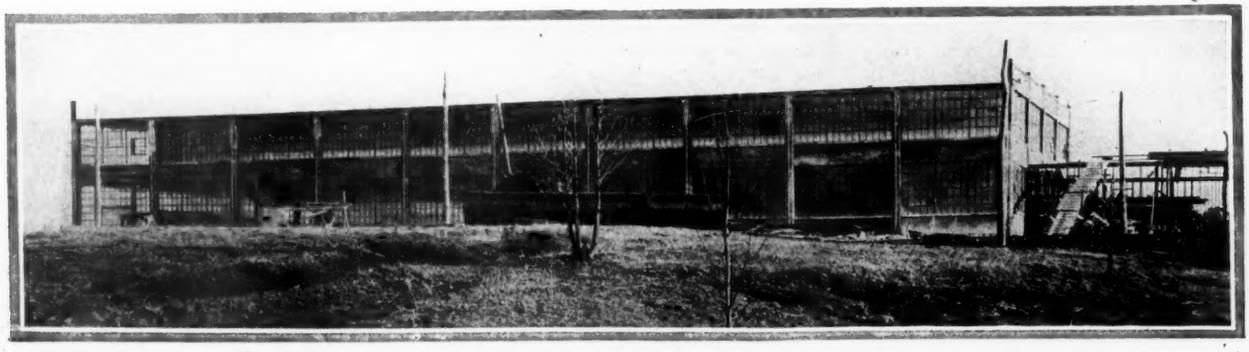
Keeler's Novel Bonus System

GRAND RAPIDS, Jan. 20—A unique bonus and profit-sharing system has been inaugurated by the Keeler Brass Co., manufacturer of automobile castings. The company opened a bank account for each employee on Jan. 2, rated in amount according to length of service and po-



New factory of the J. & D. Co., Charlotte, N. C., which has just started shipping tires to its distributors

sition occupied. In addition to the bank's 3 per cent interest the company will pay 5 per cent for all money deposited for a year, provided the worker is still in the employ of the concern. A sickness insurance plan is also in force which requires each employee to deposit 25 cents a week, and an equal amount is contributed by the company. A 5 per cent weekly bonus is paid to all employees who are punctual.

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Dealers' Licenses May Be Withheld

SACRAMENTO, CAL., Jan. 18—About 200 automobile dealers throughout California are in difficulty with the motor vehicle department of the State because they did not comply with the motor vehicle law which requires them to report all sales of automobiles to the department in this city, and the superintendent of the department has refused to issue dealers' licenses to all such dealers. As matters stand now they will be forced to take out individual licenses for every car they demonstrate or operate.

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Meara Can't Sell Carbureter Rights

TOLEDO, Jan. 20—David C. Meara has been restrained by court order from the sale of patent rights on a new carbureter improvement. The injunction was granted on application of R. W. and Fred Overmyer and J. Q. Adams, who claim they have purchased the patent from Meara and are now manufacturing it.

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Pfeffer President Realty Company

DETROIT, Jan. 22—C. A. Pfeffer, former vice-president of the Chalmers Motor Co., has been made the president of the Prudential Realty Co., a concern whose capital was recently increased to $1,000,000.

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Weber With Eugene Meyer & Co.

NEW YORK, Jan. 22—Orlando Weber, who recently resigned as director of the Maxwell Motor Co., Inc., has joined the banking firm of Eugene Meyer & Co.

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Permanent Products Co. Formed

CLEVELAND, Jan. 19—The Permanent Products Co. has been formed to manufacture metal products. Its capitalization is $1,000,000 and the incorporators are R. D. and G. R. Stevenson, L. B. Foote and W. A. Thompson, all of this city.

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Darland Manages Tulsa Company

TULSA, OKLA., Jan. 22—C. E. Darland has been appointed general manager of the Tulsa Automobile Co. W. A. King has been made factory and production manager. The Tulsa Four, the company's product, was recently exhibited at a local hotel.

Plans Tests for Brake Linings

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Asbestos Brake Lining Mfrs. Assn. Preparing for Tests by Laboratory

NEW YORK, Jan. 23—Disinterested tests of brake linings are to be made by the Asbestos Brake Lining Mfrs. Assn. The association is at present preparing a way for these tests, which will be made by a well-recognized laboratory. The idea behind the test is that they will be of value to manufacturers in showing them the qualities resulting from various methods of construction, etc. It is also planned to do some general as well as engineering work, such as the provision of tariff protection with this young industry, etc.

The association was formed July 28, 1916, the president being A. H. Burdick of the Standard Woven Fabric Co., and the secretary and treasurer, C. J. Stover of Keasbey & Mattison Co. Among the members are the following firms: American Asbestos Co., Norristown, Pa.; Asbestos & Rubber Works of New Jersey, Camden, N. J.; General Asbestos & Rubber Co., Charleston, S. C.; Essex Rubber Co., Trenton, N. J.; Federal Asbestos Co., Paterson, N. J.; F. L. Horton Mfg. Co., Boston, Mass.; Keasbey & Mattison Co., Ambler, Pa.; Russell Mfg. Co., Middletown, Conn.; Manhattan Rubber Mfg. Co., Passaic, N. J.; Standard Woven Fabric Co., Walpole, Mass.; Staybestos Mfg. Co., of Philadelphia, Pa. The offices of the association are at Ambler, Pa.

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Packard Makes Promotions

DETROIT, Jan. 21—C. F. Tollzien, has been made production manager of the Packard Motor Car Co., and will retain his present work as purchasing agent and manager of the service division. D. F. Roberts has been made the factory manager. Mr. Roberts was formerly the superintendent of the factory. J. E. Leher has been appointed as manager of the motor carriage division in charge of chassis and body manufacture. R. N. Brown has been made superintendent of the chassis division, and L. E. Jolls has been promoted to be mechanical superintendent.

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Connell, S. A. E. Secretary, Dies

MILWAUKEE, WIS., Jan. 23—Herbert L. Connell, secretary of the Mid-West section of the S. A. E., and instructor in automobile practice in the Milwaukee Continuation School system since 1914, died at his home in Milwaukee on Friday, Jan. 19, aged 29 years. Mr. Connell was a native of Detroit and was graduated from the University of Michigan, college of mechanical engineering, in 1911. He was associated with several Detroit factories, including the Packard, for 3 years before coming to Milwaukee. He was a member of the committee on standardization of the S. A. E., and a well-known writer on technical subjects. Mr. Connell was a member of the Milwaukee Press Club. The funeral was held Monday, Jan. 22.

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Schipper Will Address S. A. E.

DETROIT, Jan. 23—J. Edward Schipper, technical editor of THE AUTOMOBILE, will address the next professional session of the Detroit Section of the Society of Automobile Engineers, to be held at the Hotel Ponchartrain Feb. 16. Mr. Schipper will review the national automobile shows. Engineers from Flint, Ann Arbor, Toledo and Jackson will visit Detroit for the address and will make the trip in special trains.

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Detroit S. A. E. Nominating Committee Formed

DETROIT, Jan. 23—The nominating committee to nominate officers of the Detroit Section of the Society of Automobile Engineers at the March meeting has been appointed and includes H. E. Coffin, vice-president and consulting engineer of the Hudson Motor Co.; J. G. Vincent, vice-president of engineering for the Packard Motor Car Co.; H. W. Alden, chief engineer for the Timken-Detroit Axle Co., and H. A. Brown, engineer for the Hyatt Roller Bearing Co.

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May License All New York Drivers

ALBANY, N. Y., Jan. 19—All persons, owners or chauffeurs who operate automobiles in New York will be compelled to obtain drivers' licenses from the Secretary of State, according to a safety-first bill introduced last Tuesday by Assemblyman J. D. Kelly. The proposed law calls for the suspension and possible revocation on a third conviction of speeding during a year. This also affects intoxicated persons and those who attempt to escape after having run down a pedestrian.

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Kelsey Elected President D. A. C.

DETROIT, Jan. 21—John Kelsey was elected president of the Detroit Athletic Club, at a meeting of the board of directors, to succeed Hugh Chalmers who is retiring. He is president and general manager of the Kelsey Wheel Co. Other officers elected were A. E. Larned, first vice-president; Roy D. Chapin, second vice-president; Julius Haass, treasurer and C. A. Hughes, secretary. These officers will serve a term of 3 years.

Latin-American Market Gains

Continued Demand for American Cars—Few Exported to United Kingdom

WASHINGTON, Jan. 22—Latin-America continues to be the banner market for U. S. A. cars, as is shown by the government statistics of exports. Argentina ordered 4644 cars in the first 11 months of 1916, Chile 1129, Brazil 392, Venezuela 908, other South American countries 950, and Mexico 611. Canada doubled the imports of 1915, buying 11,777 cars; and Australia purchased 7337 cars as against 4426 in 1915.

Although Mexico has presumably been in a state of financial ruin the country has imported nearly six times the number of cars ordered the year previous, when 109 automobiles were imported.

The European market in the main is holding strong, despite the adverse legislation in some of the Allied countries, and the blockading of the Central Powers. France bought 7881 cars in the first 11 months of 1916, which was 2000 more than for the same period in 1915, this in spite of the fact that there is a 75 per cent tariff on passenger cars. The gain is probably chiefly in motor trucks and ambulance cars. This is likely also the case in Russia where 3110 machines have been imported from America.

Denmark purchased 1407 cars valued at $1,050,457, and Italy imported 256 automobiles, a gain of thirty over the preceding year. A sharp decrease was felt in the market of the United Kingdom, where the importation of passenger vehicles has been prohibited. This year only 8601 cars were imported as against 22,990 the year before.

The blockade prevented any cars from reaching Germany, and this was practically effective the year before. There has been a decrease in exports to minor European countries.

Not only in South America is there encouragement for the American manufacturer, but also in British East Indies which imported 3996 cars, in the West Indies where trade was double that of the previous year, and in Asia which showed a 100 per cent increase in demand.

New 18-Cylinder Aero Engine

DETROIT, Jan. 23—An eighteen-cylinder engine constructed by P. W. Murphy, manager of the camshaft department of the Studebaker Corp., and W. E. Looney, S. Smith and S. Pepilinski, also Studebaker employees, is on exhibition at the National Automobile School, here. The motor is intended for aeroplane purposes and is cam-driven with opposed cylinders and little head resistance. It has no crankshaft and the drive is on the drum cam. Present weight is 270 lb., but it is expected that this will be reduced to 200 lb. The motor yields 120 hp.

Brazil Needs Magnetos

WASHINGTON, Jan. 22—Brazil now furnishes an excellent market for magnetos, according to consular reports. Before the war the supply came chiefly from Europe. The bureau of foreign and domestic commerce will supply the names of probable customers for American makes upon inquiry at the Washington or branch offices.

$4,800,000 for Hydroaeroplanes

WASHINGTON, Jan. 24—A total of $4,800,000 has been recommended by the House Committee on Fortifications for putting squadrons of hydroaeroplanes in coast defenses. The measure is expected to pass.

Exports of Automobiles, Trucks and Parts for November

	November 1915 Number	November 1915 Value	November 1916 Number	November 1916 Value
Passenger cars	3,690	$2,791,507	5,337	$4,016,930
Commercial cars	1,553	3,837,307	1,655	5,175,114
Parts not including engines and tires	.....	1,693,787	.....	2,151,434
	5,243	$8,322,601	6,992	$11,343,478

NOVEMBER AND 10 PREVIOUS MONTHS, BY COUNTRIES

Denmark	.....	.....	1,407	$1,050,457
France	5,881	$14,887,732	7,881	21,381,352
Germany	4	2,800	.....	.....
Italy	226	144,874	256	158,003
Russia	.....	.....	3,110	8,464,071
United Kingdom	22,990	33,088,549	8,601	15,576,155
Other Europe	8,032	21,057,550	3,633	4,452,544
Mexico	109	102,402	611	523,186
Canada	5,448	4,363,821	11,777	8,513,315
West Indies and Bermuda	2,940	1,680,168	5,471	3,625,825
South America	.....	.....	.....	.....
Argentina	.....	.....	4,644	2,480,092
Brazil	.....	.....	392	256,878
Chile	.....	.....	1,129	769,080
Venezuela	.....	.....	508	324,992
Other South America	2,786	1,498,578	950	605,881
British East Indies	.....	.....	3,996	2,907,067
Australia	4,426	3,703,976	7,337	5,529,626
Asia and other Oceania	3,749	5,985,446	8,733	9,750,664
Other countries	2,039	1,737,181	4,172	2,898,569
	58,630	$88,253,077	74,608	$89,267,757

Export Co. Has Wide Scope

American Motors, Inc., Formed to Serve Automobile Makers in Foreign Business

NEW YORK, Jan. 19—A comprehensive service to all the automobile manufacturers in the various countries which do or contemplate doing an export business is outlined in the plans of the American Motors, Inc., this city, just formed. This export service is based on the principle and practice of intensive coordination and its activities embrace every step in the transfer from the American maker or seller to foreign buyer of any and all products related to the automobile industry. Purchasing, financing, packing, shipping and insuring of the products covered by the automobile industry for export, are included.

Through arrangements perfected with its banking connections, it is prepared to finance for foreign purchasers their shipments, covering payments to the manufacturer, packing, shipping, insurance, and such other incidental charges as are requisite in the completion of a shipment of merchandise to any part of the world.

As European conditions settle back into the normal there will be a demand for the American tools and parts. To co-operate with foreign producers along this line is a vital part of the plan of the American Motors, Inc. To this end a large amount of data has been assembled and classified for immediate use. Its technical department is prepared to furnish data, blue prints, specifications, etc., covering all classes of automobile parts or machinery. It is its intention, in addition to the packing department, which it has established in Brooklyn, to have a branch of same at Detroit, in order that purchases made from different manufacturers located in the Central West can be packed under one cover and shipped in one carload.

According to plans, a foreign buyer, by stipulating his automobile requirements to the company, will be served promptly. The company will have competent men in the field of automobiles, tractors and parts who will execute these purchases.

To simplify and expedite financial arrangements between shippers and foreign consignees is one of the features of the company's plans. The company has banking connections in the important foreign cities thus affording facilities for credits. These banking houses are correspondents of its local banking connections and through them credit may be established for all purchases to be negotiated through the American Motors, Inc. Where accessories are to be pur-

chased in addition to complete chassis the company will so plan the buying, packing and shipping as to effect the greatest possible saving in the grand total.

As planned, sight drafts will be drawn on the consignee and attached to the documents covering the shipment. In the event of drafts being drawn on the consignee at 60 or 90 days sight, the company will endeavor to arrange credits with the consignee's bankers or with its banking correspondents.

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Harroun to Justify Product

DETROIT, Jan. 24—The Harroun Motor Corp. will appear before the Michigan Securities Commission to-morrow in Lansing for the purpose of establishing the fact that the company is producing a meritorious car at a fair price.

In order to do this it has summoned a number of experts to testify as to the merits of the design and sales possibilities. Besides the officers of the company, J. G. Monihan, president; Ray Harroun, vice-president, and John Plath, director of merchandising, there are the following disinterested engineers: Professor David Gallup, J. B. Replogle, Major M. B. Hawxhurst, Victor Kliesrath, C. A. Armstrong, Vice-President Cutting Armstrong and Smity, Fred Wagner and Ralph De Palma.

Those appearing as experts on selling possibilities of the car are: J. W. Leavitt, of San Francisco; R. H. Schmittdiel, of Wetmore, Quinn, Paige and Harroun distributor; George Franklin, Dort distributor; L. J. Robinson, president of the L. J. Robinson Co., Chalmers distributor. To show the value of the plant, M. D. Smith, president of the A. J. Smith Construction Co. The reports of the auditors and appraisers will also be submitted to show the probability of the company.

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Briggs-Detroiter Settlement Decided

DETROIT, Jan. 20—Creditors of the Briggs-Detroiter Co., which failed in March, 1914, will receive about 26 per cent of their claims. The total claims allowed are $483,287, and total realized assets were $143,432. Taxes amounted to $5,177, preferred creditors have been paid $36,359, labor claims amounted to $2,461, and dividends paid unsecured creditors were $77,287. The trustee still retains a balance of $12,227.

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Will Sell Victor Assets

DETROIT, Jan. 20—The referee in bankruptcy has ordered a sale, to be held Feb. 2, of the machinery and building, valued at $43,000, of the defunct Victor Mfg. Co., makers of bodies. Liabilities amount to $45,000.

63,000 1917 Cars for Philadelphia

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41,600 Sold in That Territory in 1916—Show Attendance 100,000

PHILADELPHIA, Jan. 20—At the record-breaking sixteenth annual automobile show held in the Commercial Museum it was brought out that 41,600 cars were sold in this territory during the past year and the sales for 1917 are conservatively estimated at 63,000.

There were 117 exhibitors at the show, sixty-six showing cars and fifty-one accessories. Of the 280 cars on view, ninety-five were touring cars, eighty-five closed cars, fifty-seven roadsters, thirty were chassis, and eleven electrics. The show opened Friday evening, Jan. 12, while the New York show was still open. Attendance was close to 100,000, the daily average being over 10,000.

Commercial Museum, the new exhibition building, is the largest single-story structure in the city, being about 300 ft. square, with 75,000 sq. ft. of floorspace, as compared with 50,000 sq. ft. available for last year's show and only 27,000 sq. ft. the previous year. Decorations for this year's exhibition were of an Oriental character, and original in conception and execution. Despite an outlay of $40,000 on the show, the Philadelphia Automobile Trade Assn. will have a balance in the treasury and will be able to grant rebates to exhibiting members.

General prosperity, due in large measure to the high prices caused by the war for Pennsylvania products, is responsible for the great expansion of the automobile business in this territory. Philadelphia is the center for the outlet and utilization of the enormous natural resources in oil, coal and minerals of Pennsylvania, the first State in the Union in the manufacture of iron and steel and the second in textile products. War profits in all these fields center in this city and it is only natural that car-buying should increase remarkably in proportion. Bank clearings in 1 day during the past week suffice to reflect these conditions:

City	1917	1916	1915
Philadelphia	$62,503,236	$38,287,154	$26,114,275
Boston	46,776,627	38,442,103	26,683,258
Chicago	83,049,524	67,126,923	54,568,426
St. Louis	21,541,055	17,124,279	14,924,573
Baltimore	8,675,174	6,944,510	6,566,250
New York	716,209,433	554,273,111	300,902,163

It will be noted that Philadelphia shows the greatest percentage increase though the total clearings are third on the list.

For After-War Trade

Philadelphia intends to make this prosperity permanent. No other city perhaps has better prepared for a resumption of foreign trade after the war. During the first 11 months of the past year the export business totalled almost $300,000,000—more than double that of the previous year. Additional lines of steamships are being established for trade in foreign countries, and more than 100 vessels are under construction on the Delaware. All the wharves, piers and docks owned by the city are loaded and the demand for such facilities is increasing.

Moreover, it must be remembered that it is not from the State of Pennsylvania alone that Philadelphia draws its trade, though that alone would make it a great port. Three railroad systems center here and connect it with the West, and this city is preparing for a still greater expansion of business from this quarter.

More active promotion of good roads work is planned for the coming year when the State Highway Department will ask the Legislature to devote the $3,000,000 revenues from automobile license fees entirely to maintaining the 10,200 miles of State roads: $10,000,000 for 2 years' reconstruction of State highways in accordance with Sproul act provisions for connecting centers by beginning simultaneously at both ends; an appropriation for aiding boroughs in building State roads; and an appropriation to allow the continued absorption of toll roads around Philadelphia.

This good roads program means a still more marked increase in the sales of cars in this territory.

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Dearborn Truck Reorganized

CHICAGO, Jan. 22—The Dearborn Motor Truck Co., this city, has reorganized as the Dearborn Truck Co. and the capital has been increased to $550,000, of which $200,000 is to be preferred stock.

S. D. Porter, who was formerly vice-president and general sales manager of the Smith Form-A-Truck Co., has purchased an interest in the new company and has become vice-president, treasurer and general manager. W. J. Kenrick, who founded the Dearborn Motor Truck Co. last March, remains as president of the new company. C. E. Stuart, formerly assistant general sales manager of the Smith Form-A-Truck Co., has become sales manager of the new company.

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Kunz Wheel Co. Formed

MILWAUKEE, WIS., Jan. 20—The J. L. Kunz Machinery Co., Milwaukee, established 25 years ago, has reorganized as the Kunz Wheel Co., with $100,000 capital, to devote its attention exclusively to the manufacture of resilient sheet steel wheels for automobiles and trucks, designed by J. L. Kunz.

Aero Show Exhibitors

Over Sixty Listed, Half of Them Being Members of the M. & A. M.

NEW YORK, Jan. 23—Over sixty aeroplane, motor, parts and accessory makers have taken space at the coming initial Pan-American Aeronautics Exposition at Grand Central Palace, Feb. 8 to 15. Over half of these exhibitors are members of the Motor and Accessory Manufacturers, which recently sanctioned the event.

Many automobile manufacturers are either producing aeroplane motors to-day or else designing aeroplane motors for future delivery. With the recent appropriation of $35,000,000 by the United States Government for the purchase of aeroplanes, to be used in connection with the army, navy and post office departments, the making of aeroplanes and parts for these will rank as one of the United States' foremost industries. Members of the Motor and Accessory Manufacturers will make quantity production possible for the aeroplane industry.

The following list of exhibitors will show the large number of automobile accessory and parts makers that are entering the aeroplane industry.

AEROPLANE MANUFACTURERS

(Flying Boats and Balloons)

Lawrence Lewis Aeroplane Co., Chicago, Ill.
Aeromarine Plane & Motor Co., Times Bldg., New York.
The Burgess Co., Marblehead, Mass.
Curtiss Aeroplane & Motor Co., Buffalo, N. Y.
Connecticut Aircraft Co., New Haven, Conn.
John D. Cooper Aeroplane Co., Bridgeport, Conn.
Christofferson Aircraft Co., 61 Broadway, New York.
L. W. F. Engineering Co., College Point, N. Y.
Samuel S. Pierce Aeroplane Corp., Hampton, L. I.
Standard Aeroplane Corp., Plainfield, N. Y.
Sturtevant Aeroplane Co., Jamaica Plains, Mass.
Thomas Bros. Aeroplane Co., Ithaca, N. Y.
Wright-Martin Aircraft Co., 60 Broadway, New York
Eastern Aeroplane Co., Brooklyn, N. Y.
Witteman-Lewis Co., Newark, N. J.
New Jersey Aeroplane Co., Paterson, N. J.

MOTOR MANUFACTURERS

R. J. Collier, New York.
General Vehicle Co., Long Island City.
Trebert Motor Co., Rochester, N. Y.
Aeromarine Plane & Motor Co., New York City.
Curtiss Aeroplane & Motor Co., Buffalo, N. Y.
B. F. Sturtevant Co., Jamaica Plains, Mass.
Thomas Bros. Aeroplane Co., Ithaca, N. Y.
Wright-Martin Aircraft Co., New York City.
Packard Motor Car Co., Detroit, Mich.
Springfield Motors Co., Springfield, Mass.
Wisconsin Motors Co., Milwaukee, Wis.
World's Motor Co., Milwaukee, Wis.

PARTS AND ACCESSORIES, ETC.

Charles D. Woodward, Providence, R. I.
Texas Co., New York City.
Christensen Engineering Co., Milwaukee, Wis.
Janney-Steinmetz Co., Philadelphia, Pa.
Stromberg Motor Devices Co., Chicago, Ill.
Hayes Manufacturing Co., Detroit.
Clarence Whitman, New York City.
Dayton Engineering Laboratories, Dayton, Ohio.
Doehler Die Casting Co., Newark, N. J.
Vacuum Oil Co., New York City.
Standard Parts Co., Cleveland, Ohio.
American Bronze Co., Berwyn, Pa.
Northeast Electric Co., Rochester, N. Y.
Sperry Gyroscope Co., Brooklyn, N. Y.
Abercrombie & Fitch Co., New York City.
Aluminum Castings Co., Cleveland, Ohio.
Aviation & Aeronautic Engineering, New York.
Champion Ignition Co., Toledo, Ohio.
Du Pont Chemical Co., Wilmington, Del.
Erie Specialties Co., Erie, Pa.
Ericsson Mfg. Co., Buffalo, N. Y.
Goodyear Tire & Rubber Co., Akron, Ohio.
Herbert & Huesgen, New York City.
Keasby & Mattison Co., Penn.
Motor Boating, New York.
Motor Compressors Co., Newark, N. J.
Moto-Meter Co., Long Island City, N. Y.
Radium Chemical Co., Pittsburgh, Pa.
John A. Roebling's Sons, Trenton, N. J.
Standard Screw Co., Detroit, Mich.
Taylor Instrument Co., Rochester, N. Y.
U. S. Rubber Co., New York City.
Valentine Varnish Co., New York City.

GOVERNMENT EXHIBITS

War Department.
U. S. Army (including aviation section).
U. S. Navy.
Bureau of Standards.
Weather Bureau.
U. S. Geodetic Survey.

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Chicago Salon in Congress Hotel

CHICAGO, Jan. 22—Chicago's automobile salon will be held in the Elizabethan room of the Congress Hotel. Nine automobile makers will exhibit: Locomobile, Brewster, White, Simplex, Murray, Daniels, Disbrow, Lancia, Fageol. C. P. Kimball & Co. of Chicago will exhibit body work, showing models of the Marmon and Doble cars.

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Commerce on Exhibition at Chicago

CHICAGO, Jan. 24—The Commerce Motor Car Co., Detroit, will exhibit its trucks during the local automobile show at its dealer's showroom, Commercial Motor Truck Co., 1718 Indiana Avenue.

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Spranger Wheel Changes Name

DETROIT, Jan. 22—The name of the Spranger Rim and Wheel Co. has been changed to the Spranger Wire Wheel Co. and the capital stock has been increased from $100,000 to $300,000. The management has been taken over by the following new officers: J. A. Lancaster, H. E. Adams, and J. Roberts. It is planned to increase the output to more than 500 sets of wheels daily and to employ 300 workmen.

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Little Joins Nash Motors

KENOSHA, WIS., Jan. 21—P. G. Little has been appointed chief inspector of the Nash Motors Co. Little was a motor truck inspector for the French Government at the beginning of the war.

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National Acme Plans Dividend Action

CLEVELAND, Jan. 22—It has been predicted by high authority, that the annual meeting of the stockholders of the National Acme Co., which will be held late this week, will witness an increase of directors, an arrangement for quarterly dividends of 6 per cent to be paid beginning in March, and the approval of plans for construction of new buildings amounting to 6 acres of floorspace. The company has had profits for the past year amounting to about $6,000,000.

North American Merger

Manufacturer of Gasoline Motors Buys Out Two Competing Companies

PHILADELPHIA, Jan. 18—The North American Motors Co., Pottstown, Pa., which was incorporated last November to manufacture gasoline motors for automobiles and for general machine work, has bought the assets of the Potter Mackie Mfg. Co., with a factory in Pottstown, and the North American Motor Co., a partnership manufacturing gasoline motors.

Edmund J. Levine, president of the Fibreoid, New York, has been elected president of the North American Motors Co. S. C. Potter of Pottstown was elected vice-president; G. C. Lees, secretary, and treasurer, and F. W. Fahringer, assistant treasurer.

This spring and early summer it expects to build a plant on a 4-acre plot which it has bought on Queen Street, Pottstown, which will be suitable for its work, the manufacture of 45, 30 and 20-hp. motors, formerly under the name of Hazard, for commercial vehicles.

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Hayes Mfg. Stock on Sale

DETROIT, Jan. 22—The stock of the Hayes Mfg. Co., which recently increased its capital, is being offered for sale. The stock offered amounts to $625,000 and is the new issue, the concern now being capitalized at $1,500,000. The dividend rate is 12 per cent, payable quarterly.

The business of the company has increased from $750,000 to $3,500,000 within the past 2½ years, and net earnings applicable for dividends have increased from $103,760 for the fiscal year ending June 30, 1915, to $280,000 for the same period ending June 30, 1916.

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Acme Truck Elects Directors

CADILLAC, MICH., Jan. 22—At the annual meeting of the Cadillac Auto Truck Co. the following men were elected directors: W. A. Kyser, C. J. Helm, John P. Wilcox, F. O. Gaffney, Henry Ballou, Henry Knowlton, Perry F. Powers, J. C. Ford and D. E. McMullan. Secretary Helm's report showed more than 200 trucks had been made and shipped during the company's first year.

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Wolverine Tractor Stock on Market

DETROIT, Jan. 20—The Wolverine Tractor Co., Wayne, Mich., is now selling its stock to the public, following permission by the State Securities Commission. The concern has been assembling machines in its plant at the Prouty & Glass factory since last summer.

$18,306,429 Firestone Surplus

$325,490 Cash on Hand Shown in a Statement as of Oct. 31, 1916

AKRON, Jan. 23—The balance sheet of the Firestone Tire & Rubber Co., as of Oct. 31, 1916, shows cash amounting to $325,490; notes and receivable, $6,820,632; inventory, $9,715,949; notes payable, $5,245,843; accounts payable, $1,671,305; surplus, $18,306,429, and total assets and liabilities, $34,360,848.

The Firestone Tire & Rubber Co.'s consolidated balance sheet as of Oct. 31, 1916, is as follows:

ASSETS

Real estate and plant	$10,687,963
Investments in securities	647,923
Inventory	9,715,950
Subscriptions of pfd. 6% cumulative stock	5,008,775
Cash	325,490
Notes and accounts receivable	6,829,632
Due from employes' account stock bought	1,107,083
Reserve for future operations	38,032
Total	$34,360,848

LIABILITIES

Preferred 6% cumulative stock	$5,000,000
Common stock	3,000,000
Notes payable	5,245,844
Accounts payable	1,271,305
Taxes, interest, wages, etc.	386,852
Welfare and pension reserve	1,000,000
Insurance reserve	150,418
Surplus	18,306,429
Total	$34,360,848

Leather Tire Goods Changes Name

NIAGARA FALLS, Jan. 22—Woodworth Mfg. Co. is the new name of the Leather Tire Goods Co., which has been taken over in its entirety by this new company. The Woodworth company will carry on the business without change. There is no change in the personnel of the company.

J. W. Murray Doubles Capital

DETROIT, Jan. 19—The J. W. Murray Mfg. Co., this city, maker of sheet-metal parts for automobiles, has increased its capital from $500,000 to $1,000,000, to be taken care of by a 100 per cent stock dividend.

The new issue will be placed on a 16 per cent yearly cash basis, payable 4 per cent quarterly. This follows the company's recent statement of net earnings for the year 1916 of upward of $240,000.

The company has recently added extensively to its factory, which will enable it to about double its output.

The following compose the board of directors: J. W. Murray, president; L. G. Schwartz, vice-president; J. R. Murray, secretary and treasurer; William Blanck, F. G. Schwartz, Andrew Murray and Edward Stephens.

Gier Increases to $1,000,000

LANSING, MICH., Jan. 20—The Gier Pressed Steel Co. has increased its capital from $500,000 to $1,000,000, at a meeting of stockholders held this week. Officers elected were: W. K. Prudden, president; H. F. Bradner, vice-president; B. S. Gier, secretary and general manager; D. F. Edwards, treasurer. These officers and L. F. Price, E. Verlinden, H. F. Harper and W. H. Newbrough form the board of directors. A 25 per cent stock dividend was authorized.

The business of the company was 50 per cent greater for 1916 as compared with that of 1915. Among the concerns placing orders with the company are the Auto Body Co., Olds Motor Co., Auto Wheel Co., and the Reo Motor Car Co.

Tubeless Tire Increases Capital

MILLERSBURG, OHIO, Jan. 21—The Tubeless Tire & Rubber Co. has increased its capital from $75,000 to $1,000,000.

Continental Transfer Involves $1,920,000

DETROIT, Jan. 23—Distribution of $1,920,000 in cash and 200 per cent in stock dividends was made available to stockholders of the Continental Motors Co. to-day, the date for the exchange of the new stock for old under the recently announced reorganization plans.

The transfer of stock provides for a 50 per cent cash dividend and the exchange of three shares of the new stock for each share of old, the new stock having a par value of $10.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum, lb.	.58	.57	.57	.57	.57	.56	— .02
Antimony, lb.	.14½	.14½	.15	.15	.15	.15½	+ .01
Beams & Channels, 100 lbs.	3.62	3.62	3.62	3.62	3.62	3.62	...
Bessemer Steel, ton	60.00	60.00	65.00	65.00	65.00	65.00	+5.00
Copper, Elec., lb.	.29	.29¼	.29¼	.29¼	.29¼	.30½	+ .01½
Copper, Lake, lb.	.29	.29¼	.29¼	.29¼	.29¼	.30½	+ .01½
Cottonseed Oil, bbl.	12.20	12.30	12.40	12.60	12.40	12.70	+ .50
Fish Oil, Menhaden, Brown, gal.	.73	.73	.73	.73	.73	.73	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.30	1.30	1.35	1.35	1.35	1.35	+ .05
Lead, 100 lbs.	7.70	7.70	7.80	7.80	7.80	7.80	+ .10
Linseed Oil, gal.	.93	.93	.95	.95	.95	.95	+ .02
Open-Hearth Steel, ton	60.00	60.00	65.00	65.00	65.00	65.00	+5.00
Petroleum, bbl., Kan., crude	1.70	1.70	1.70	1.70	1.70	1.70	...
Petroleum, bbl., Pa., crude	3.05	3.05	3.05	3.05	3.05	3.05	...
Rapeseed Oil, refined, gal.	1.00	1.00	1.00	1.00	1.00	1.00	...
Rubber, Fine Up-River, Para, lb.	.77½	.77½	.77½	.77½	.77½	.76½	— .01
Rubber, Ceylon, First Latex, lb.	.77	.80	.80	.79	.78	.77	...
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	44.50	45.00	45.00	45.50	45.50	45.50	+1.00
Tire Scrap, lb.	.06½	.06½	.06½	.06½	.06½	.06½	...

Gasoline Prices Are Still Higher

All Sections of United States Are Affected by New Rate Increase

NEW YORK, Jan. 19—Further increases are reported from different sections of the country this week, ranging from 1 to 5 cents. The rapid advance in crude oil has been responsible. Pennsylvania crude is now selling at $3.05 per barrel.

The Atlantic Refining Co. has raised prices 2 to 5 cents a gallon in Pennsylvania. In the future the three automobile grades will be as follows: 68-70, 26 cents; 70-73, 29 cents, and 73-76, 33 cents.

The Texas Co. has made an advance of 1 cent a gallon in the South. The following are the new maximum and minimum prices: Maryland, 22-21 cents a gallon; Virginia, 23½-21½; North Carolina, 24-22; Georgia, 26-23½; Florida, 25½-23; Alabama, 27-23½, and Oklahoma, 23, tank-wagon basis.

The Standard Oil Co. has advanced prices 1 cent, to 24 cents, in Boston. The price has been 23 cents since Aug. 11.

The third increase in gasoline prices in the Milwaukee district since Jan. 1 was made Jan. 17, when ½ cent was added to the entire list. On Jan. 3 prices were raised 1 cent, and on Jan. 9 the low grade fuel was advanced 1 cent. The cheapest gasoline now sells for 21 cents per gallon at filling station and 20 cents tank wagon basis.

Gasoline prices have been advanced 1 cent a gal. in the following States. The net maximum and minimum prices are: Colorado, 26, 23; Montana 25½, 24; New Mexico 26, 22; and Wyoming, 24, 20½.

Steel and Copper Higher

NEW YORK, Jan. 24—Prices of automobile materials last week were generally higher, especially in the metals and oils. Copper rose to 30½ cents a pound, a gain of 1½ cents, and Bessemer and open-hearth steel reached the $65 mark per ton, a new high. Notwithstanding reports that rubber prices would be affected by the German shipping raids, rubber prices have remained constant, with Para going down to 76½, a drop of 1 cent a pound. Ceylon grade fluctuated throughout the week, its highest quotation being 80 and its lowest 77.

Change in Hydraulic Steel Refinancing

CLEVELAND, Nov. 27—Since the announcement last November of the formation of a $10,000,000 company, to include the Hydraulic Pressed Steel Co. and the Cleveland Welding & Manufacturing Co.,

there has been much delay in the final negotiations being put through.

The original scope of the refinancing plans, it seems, has been broadened. J. H. Foster, vice-president and general manager of the Hydraulic company, is renewing options on stock of the Cleveland companies on the following terms: The same price for the stock as in the original terms, 270, but instead of 40 per cent of the price being paid in cash and 60 per cent in stock, it is now planned to pay 25 per cent cash and 75 stock.

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To Organize Liberty Body Co.

DETROIT, Jan. 21—The Liberty Body Co. is being organized in Detroit to make commercial bodies. Prominent men of the industry are said to be interested.

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Dividends Declared

Kelsey Wheel Co., quarterly of $1.75 a share on preferred, payable Feb. 1 to stock of record Jan. 16.

Stewart-Warner Speedometer Co., quarterly of 1½ per cent, payable Feb. 15 to stock of record Jan. 30.

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100 per Cent Stock Dividend for Bower

DETROIT, Jan. 23—The Bower Roller Bearing Co. has declared a stock dividend of 100 per cent and a cash dividend of 15 per cent, payable to stock of record Jan. 18.

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Hoover Declares Dividend

DETROIT, Jan. 21—The Hoover Steel Ball Co. declared a 5 per cent monthly dividend payable Feb. 1 to stockholders of record on Jan. 22.

Automobile Issues Stronger

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General Motors, Chevrolet and United Motors Make Substantial Gains

NEW YORK, Jan. 24—The automobile and accessory securities last week were featured by a general increase in prices. Automobile issues were exceptionally strong. The old stock of General Motors rose to 750, a gain of 250 points, Chevrolet rose 13 points to 115 and United Motors rose to 47¾, a gain of 6¼ points.

Firestone common recorded a drop of 8 points, Fisk dropped 5 points and Portage 4 points. Whether or not these declines were due to the activities of the German raider is not known, but it is stated that these shipping raids have affected rubber supplies.

Favorable rumors have been made from Wall Street in regard to the motor issues. For instance, United Motors has seen excellent buying on account of the statement that its earnings are running close to $15 a share. Maxwell stock started upward last week. Rumors had it that its sales and deliveries of cars are far ahead of what they were a year ago. The Maxwell company, it is stated, has covered its steel requirements for this year at prices far below the present level.

Goodrich stock is stronger on account of the coming stockholders' meeting when it is expected that Goodrich will show earnings equal to 13 per cent for the common. Though this would compare with 17 per cent in the 1915 year, the 1916 sales are estimated at $73,000,000, a gain of 30 per cent.

Yesterday the stock market was governed by conflicting influences all through the day. President Wilson's speech seemed to improve prices, a rally taking place following the announcement of the speech.

The recent readjustment of the capitalization of the International Motors Co. has resulted in a big improvement in the company's working capital. Orders on hand at the beginning of 1917 were larger than 1916 and the output for this year is expected to reach at least 3000 trucks. The common stock as a result of this favorable report rose 2 points to 18.

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National Earnings for 1917 Estimated at $1,000,000

INDIANAPOLIS, Jan. 23—The National Motor Car Co., this city, is largely oversold this year. The demand is far in excess of the capacity. Earnings for the year ending Nov. 30, are estimated at about $1,000,000 or equivalent to $12.50 per share on the 80,000 shares of stock outstanding. This compares with net of $425,000 for the last year of the old company, or $5.30 per share.

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N. Y. Pullman in Receivers' Hands

NEW YORK, Jan. 20—William A. Keyworth, Carlton L. Hoff and Henry Schmidt, who were recently appointed receivers of the York Motor Car company, York, Pa., by the York county courts were appointed receivers this

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
Ajax Rubber Co	72½	74	+2¼
J. I. Case T. M. Co. pfd	85	88	—1½
Chalmers Motor Co. com	25	30	—5
Chalmers Motor Co. pfd	..	..	..
*Chandler Motor Car Co	99	102	+1½
Chevrolet Motor Co	115	125	+13
Fisher Body Corp. com	37	40	— ½
Fished Body Corp. pfd	94	98	+14
Fisk Rubber Co. com	75	85	—5
Fisk Rubber Co. 1st pfd	110	115	..
Fisk Rubber Co. 2d pfd	90	100	..
Firestone Tire & Rubber Co. com	140	145	—8
Firestone Tire & Rubber Co. pfd	107	108½	+1
*General Motors Co. com	750	..	+250
*General Motors Co. pfd	120	125	+1
*B. F. Goodrich Co. com	60	61	+4¾
*B. F. Goodrich Co. pfd	110½	112	..
Goodyear Tire & Rubber Co. com	278	282½	—2
Goodyear Tire & Rubber Co. pfd	107½	108¼	+ ¼
Grant Motor Car Corp	7	9	+2
Hupp Motor Car Corp. com	3	4	..
Hupp Motor Car Corp. pfd	..	..	..
International Motor Co. com	18	20	+2
International Motor Co. 1st pfd	68	75	..
International Motor Co. 2d pfd	25	35	..
Kelly-Springfield Tire Co. com	59	60	+2
*Kelly-Springfield Tire Co. 1st pfd	92½	95	+2½
*Lee Rubber & Tire Corp	23	23½	..
*Maxwell Motor Co. com	58½	58¾	+4¾
*Maxwell Motor Co. 1st pfd	71¾	73½	+ ¾
*Maxwell Motor Co. 2d pfd	38½	39¾	+2½
Miller Rubber Co. com	248	255	+1
Miller Rubber Co. pfd	107½	108½	+1½
Packard Motor Car Co. com	165	170	..
Packard Motor Car Co. pfd	100½	103	—1
Paige-Detroit Motor Car Co	40¼	41¼	+ ¼
Peerless Truck & Motor Corp	17	20	+1
Portage Rubber Co. com	164	166	—4
Regal Motor Car Co. pfd	..	35	..
Reo Motor Truck Co	..	..	..
Reo Motor Car Co	38¾	39½	+1¼
Saxon Motor Car Corp	64	67	..
Springfield Body Corp. com	..	..	..
Springfield Body Corp. pfd	..	..	..
Standard Motor Construction Co	5½	6½	..
Stewart-Warner Speed. Corp. com	99	100	— ½
*Studebaker Corp. com	108	108⅝	+3½
*Studebaker Corp. pfd	108½	110½	..
Swinehart Tire & Rubber Co	84	87	+6
United Motors Corp	47¾	47⅞	+6¼
*U. S. Rubber Co. com	60⅛	60½	+1
*U. S. Rubber Co. pfd	110¼	111	+1¼
White Motor Co	51	51½	+2
*Willys-Overland Co. com	36½	36⅝	+ ¾
*Willys-Overland Co. pfd	97½	98½	+1

*At close Jan. 22, 1917. Listed New York Stock Exchange.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co	..	45½	..
Chalmers Motor Co. com	..	..	..
Chalmers Motor Co. pfd	..	..	..
Continental Motor Co. com	..	38¼	..
Continental Motor Co. pfd. (new)	99½	..	+90
Ford Motor Co. of Canada	260	263	+10
General Motors Co. com	..	..	..
General Motors Co. pfd	..	..	..
Maxwell Motor Co. com	57	59	+7
Maxwell Motor Co. 1st pfd	..	..	..
Maxwell Motor Co. 2d pfd	..	..	..
Packard Motor Car Co. com	..	166	..
Packard Motor Car Co. pfd	..	..	..
Paige-Detroit Motor Car Co	40¾	41¼	+1½
W. K. Prudden Co	49¼	51	— ¼
Reo Motor Car Co	38⅞	39	+1⅞
Studebaker Corp. com	108	109	+5
Studebaker Corp. pfd	..	..	..
C. M. Hall Lamp Co	..	31	..

INACTIVE STOCKS

Atlas Drop Forge Co	35½	38½	..
Kelsey Wheel Co	50	54	..
Regal Motor Car Co. pfd	..	35	..

week for the local property of the company by Judge A. N. Hand, in the Federal Court, and were authorized to continue the business of the concern at the branch at 1892 Broadway. The New York branch in 1916 sold 677 automobiles, valued at $455,000.

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N. Y. Mitchell Enlarges Scope

NEW YORK, Jan. 22—The Mitchell Motor Car Co., this city, has taken over the entire wholesale, as well as the retail, distribution of Mitchell cars in the Eastern territory. This includes Manhattan, Brooklyn, Long Island, a large part of New York, all of New Jersey and parts of Massachusetts, Connecticut, Delaware and Maryland.

—

Hammond Goes to Cleveland

CLEVELAND, OHIO, Jan. 20—F. N. Hammond, recently branch manager at Youngstown, Ohio, has been made branch manager at Cleveland, succeeding R. S. Hartzell, who has been placed in charge of manufacturers' business in Cleveland and vicinity under the jurisdiction of the Detroit district office. Hartzell's headquarters will continue at Cleveland.

—

Kaufman Joins N. Y. Jobber

NEW YORK, Jan. 20—Carl Kaufman, prominent in the automobile accessory business in this city, has joined the Auto Hardware & Equipment Co., this city, as general manager. This company, which is a large jobber, will move from its present location in Warren Street to 256 West Fifty-fifth Street.

—

McKay With Michigan Electric

DETROIT, Jan. 21—David McKay has become the Michigan sales representative for the Michigan Electric Welding Co., a member of the Steel Products Co.

—

Dimond Handling Detroiter

NEW YORK, Jan. 22—Dimond Motor Car Co., 1860 Broadway, has taken on the distribution of the Detroiter for the metropolitan district, New Jersey, and New York State up to Albany.

—

New Stearns-Knight Toledo Agency

TOLEDO, Jan. 21—The firm of Nickels, Jackson & Lavenberg has been formed here, to handle the agency for the Stearns-Knight cars. The company was incorporated for $25,000.

—

Farnham Joining Gibson-Hollister

JAMAICA PLAIN, MASS., Jan. 20—Frank R. Farnham has been appointed director of sales and advertising for the Gibson-Hollister Co., this city. Formerly he was associated with the McGraw Publishing Co., New York.

Alley To Race Chicago Six

—

Will Appear First at Indianapolis Race—Speedway for Salt Lake

CHICAGO, Jan. 18—Tom Alley will drive a Chicago Six during 1917 and will make his first appearance with the new mount at the Memorial day race, Indianapolis. Alley is now building the car for the Pan-American Motors Co., and is fitting one of Harry Miller's new aluminum engines, similar to the one with which Barney Oldfield will campaign his Delage. This engine has aluminum cylinder jackets and is so arranged that by slipping sleeves of different size inside the jackets the cylinder bore can be altered to conform with the piston displacement limit of different races throughout the season. The change from a 450-in. engine to 300-in. engine can be made in about 2 hr. The engine also has a feature that all water and oil leads are within the cylinder casting.

Miller is building six of these engines, one or two of which Oldfield will have, and one goes to Alley. Miller also is building a twelve-cylinder aviation engine along the same lines which Oldfield may use in exhibition and time record work.

—

2-Mile Speedway for Salt Lake City

SALT LAKE CITY, UTAH., Jan 23—An automobile speedway is being planned for this city. It will be built on the Bamberger tract, immediately north of Beck's hot springs, costing $300,000. The Salt Lake Speedway Assn. has filed articles of association.

It proposes building a 2-mile board track 50 ft. wide on the straightaway and 75 ft. wide on banked turns. Seating capacity will be for 30,000. The speedway is expected to be finished by Sept. 1.

—

Rickenbacher Detained by British

CHICAGO, Jan. 18—Predictions that E. V. Rickenbacher's surname would get him into trouble with the Allies on his trip to Europe in his search for a racing mount for Indianapolis interests were proving true in a letter just received. Rickenbacher writes he was detained several days at Liverpool by the authorities, who thought he might be a German spy. He was released after a few days and has gone on to Paris.

—

U. S. To Test Hydro Automobile

CANTON, OHIO, Jan. 20—The Hydro Motor Car Co., incorporated for $100,000 will begin at once the construction of hydro automobiles; preliminary tests are to be held before government experts in February.

The car is designed to run backward on water by means of special propellers. When land is reached the land wheels take a firm grip. A feature of the car is that it can be used as an armored machine either on land or water. R. E. Hay, J. P. Snider, H. O. Myers, H. N. Pattison and E. N. Kautz, are the incorporators.

The manufacturers of the car claim they have the assurance of contracts from the government if all tests are satisfactory.

—

Diamond T Truck on Test Trip

CHICAGO, Jan. 22—A 2-ton truck with capacity load has been sent by C. A. Tilt, president of the Diamond T Truck Co., on a trip from Chicago to Tampa, Fla., over the Dixie Highway. The truck is in charge of Bill Paull and Tom Phillips, Wisconsin woodsmen, who report that the roads are in bad condition. The load consists of spare parts for Hixon & Warder, South Florida distributors of the Diamond T trucks.

—

Larson Builds Large Service Station

NEW YORK, Jan. 19—To meet the demand from his new territory, embracing all the Atlantic Coast States from Connecticut to Georgia, C. H. Larson, president of the Oldsmobile Co. of New York, has started the construction of what will be one of the largest service stations in the East. It is located in West Sixty-fourth Street, near Broadway, and covers a plot 100 by 150 ft. Five floors will contain 70,000 sq. ft. of space.

—

Eschner Buys Winton Branch

ST. PAUL, MINN., Jan. 21—Leroy Eschner has bought the St. Paul branch of the Winton Motor Co. and will carry on the business as a new organization called the Eschner Motor Co. Mr. Eschner was for 4 years manager of the branch. He made the change because it was desirable to add a smaller car to the Winton line, which is not possible under the present Winton branch-house arrangement.

—

Fletcher in Southwest for Mitchell

DETROIT, Jan. 21—H. M. Fletcher has become the district representative in the Southwest for the Mitchell Motors Co., Inc., of Racine, Wis. He was formerly district manager for the Maxwell Motor Co., Inc.

—

Newman Takes on Hal

CLEVELAND, Jan. 19—Harry Newman of Chicago has taken on the selling rights of the Hal. He has formed a new company which will be known as the Harry Newman Co. His territory will cover the middle west.

1917 Rules for Canadian Tourists

24,223 U. S. Cars Enter Provinces in 1916—Ontario Registers 17,282

TORONTO, ONT., Jan. 20—Strict requirements for the admission of automobiles of non-resident tourists are being made by the Canadian Customs Department. The 1917 rules provide that the American tourist must present his license permit at the Canadian port of entry. This will be accepted if his trip is not to exceed 24 hr. It will be taken by the collector of customs and retained until the owner recrosses the boundary, which he must do at the point of entry.

Cannot Avoid War Taxes

A bonding certificate will be issued at the port of entry for anyone wishing to remain in the Dominion from 1 to 30 days; and this will be cancelled at any port through which the tourist passes in leaving the country. A guarantee company's bond will be required from anyone desiring to remain in Canada up to 6 months over the 30 day period. The bond will be cancelled at the point where the non-resident motorist leaves, and the cancelled copy must be returned to the port of issue.

Any tourist remaining in the country over the 6 months' period must pay the 35 per cent duty and 7½ per cent war tax on his car. No Ontario license is needed for a period of 21 days for the pleasure cars owned by residents of the eighteen states having a reciprocal agreement with the province. The free period will probably be extended to 30 days in February. All commercial vehicles or demonstrating models must have individual Ontario licenses.

24,223 Enter Canada

During the past year 24,223 tourists' automobiles were admitted from the United States to Ontario and Quebec, according to the reports of the collectors of customs of these provinces. The greatest traffic was at Windsor, across from Detroit, which recorded the passage of 8880 cars. The biggest "drive" was on Labor Day, when more than 1800 cars came into Canada from Detroit. Niagara Falls registered 3489 during the year, Walkerville on the Detroit River 2592, Bridgeburg opposite Buffalo 1917, and Lacolle, Que., 3020. The total for Quebec during 1916 was 6941, or more than double the year before.

In Ontario the totals of incoming tourists' cars for the past 3 years were: 1916, 17,282; 1915, 5685; 1914, 6403.

—

McMartin Is Fisk Branch Manager

BUTTE, MONT., Jan. 20—E. T. McMartin has been made branch manager of the new Fisk Rubber Co. district which includes Butte, Salt Lake City, Minot and Bismark.

—

Apelco Is Starting System Name

NEW YORK, Jan. 22—In the list of car specifications appearing in THE AUTOMOBILE for Jan. 4, the Apelco electric system, manufactured by the Apple Electric Co., Newark, N. J., was incorrectly given as the Apple. No starting system was ever manufactured under the latter name.

Rope Tire Used in Australia

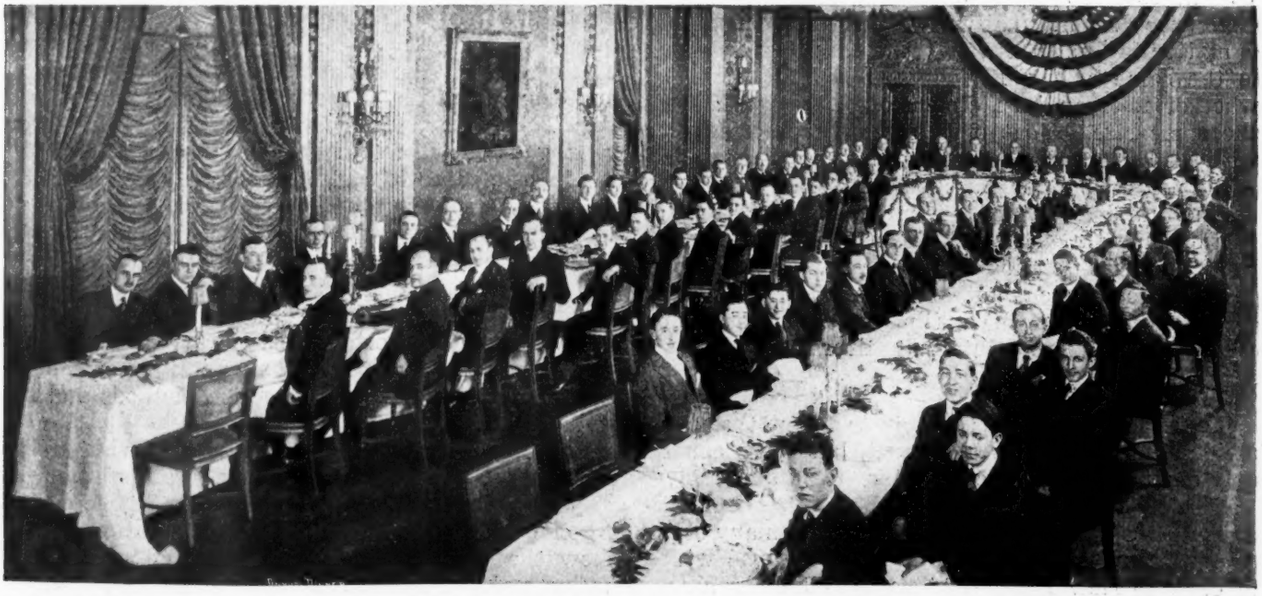
Puncture Proof Construction Takes Place of Inner Tube and Cover

NEW YORK, Jan. 22—A rope automobile tire made of coir fibre and bullet, nail and glass proof has appeared in Australia. The advent of the automobile in Australia has, to a very considerable extent, solved the difficulties of transportation. In many parts of the country the roads are merely bush tracks or overland stock routes. The rough nature of the country over which the cars travel and the excessive heat often experienced have made the cost of rubber tires a serious item in maintenance.

As a result many experiments were made to obtain a substitute for rubber at a moderate cost. Tests with tires made of various kinds of fiber were made, with the result that coir fiber was found to be the most suitable for the purpose because of its lightness, cheapness, resilience and durability.

When first placed on the market, the homing tire, as it was called, was sold as an emergency tire, in case of puncture or blowout, but it proved so satisfactory that in the country districts of some of the States the rope tires are frequently used on all the wheels. It is claimed that if a speed of 16 m.p.h. is not exceeded they are almost as soft riding as pneumatic tires.

It should be understood that the homing tires take the place of both inner tube and cover, being attached to the rim by four or five straps.



Annual dinner of the united editorial and business staffs of the Class Journal Co., publisher of THE AUTOMOBILE, Motor Age and Motor World, held at the Hotel McAlpin during New York show week

The Automobile

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Metric Standards

THE American aviation industry has now to face the decision as to what extent, if any, it will make use of metric standards of measurement. For example, engine designers are calling for a spark plug smaller than the S. A. E. standard; shall it be 1 in. across the hexagon or shall it be 25 mm.? The difference does not matter to the engineer, nor does it matter to him in a way if the thread of the plug is the same as the British standard, 18 mm., or whether it is an inch dimension of approximately the same size. That is to say, interchangeability with the European plug does not bother the engineer.

But it does bother the men who have to use the engines, and they are beginning to ask for the British plug thread and the French millimeter propeller mounting standard. There is an idea abroad that the government authorities are anxious to encourage the use of the millimeter as the standard of dimension throughout their aircraft.

Use the Millimeter

That the wise thing to do is to adopt the millimeter admits of much argument, but there can be only one ultimate answer and that is an affirmative. Ultimately the whole world *must come to one standard of measurement* and one standard in many other things. Suppose that the Illinois dollar was worth 98 cents in New York, 102.5 cents in Michigan currency, and something else in California; think of the appalling muddle and waste of time that would result. It is unthinkable, yet the nations of the earth are not so far apart as were New York and Illinois a hundred years ago.

That England must come to the metric standard of measurement soon is now admitted. England has stood aloof from all Continental standardization, has watched all the other nations of Europe come to a common understanding, and watched *unmoved* till the automobile industry sprang into being. The British automobile trade is divided, some using the inch and some the millimeter, though most the latter. All tires are millimeter sizes in England and have been for years; all engines for aircraft almost without exception are built throughout to millimeters. Recently the most noticeable change is that tolerances are beginning to be stated in metric. For a long time after using metric main dimensions the tolerances were still quoted in inch thousandths, and all British makers stick to feet and inches for specifying wheelbase. Thus the British industry is in a confused condition between two standards.

America Left Alone

That England could hold out so long against the pressure of France and Germany and Italy was due to two things. The most important was the colonial market which thought in inches with the greater facility, the other was the attitude of America. Thus we have seen America and England invading the British Empire, and leaving the South American countries and other places to Continental Europe. It is not a language question. French and German are not spoken a great deal in South America. Your German must learn his South American tongue just as much as your American.

As soon as England breaks away from tradition and goes to metric standards America will be left alone in the world and America's commerce will be hampered in all engineering exportation by the use of a standard of measurement unknown anywhere else in the world. It cannot be allowed. Whatever may seem to be the state now, whatever may be the cost of making the change, it will have to be done, and every day it is postponed the more costly it will be. To set, say, 1930 or 1940 as the change-over year would cost America far less than adherence to the inch is going to cost her before 1925 is done.

A number of years ago the proposal was made in various quarters of the automobile industry to standardize on the metric system of measurements and considerable discussion was carried on at the time in regard to the advisability of such a movement. Naturally, established companies opposed the idea, since its adoption would entail an enormous expense in alteration of production methods and installation of new machinery, etc.

The opportunity now offered to the aviation industry is to take the first step. As aviation is playing an enormous part in bringing people closer together it is eminently suitable that aviation should show the way to a closer understanding between nation and nation. It is so easy, it costs so little to start a new industry on a metric standard, and a cent invested this way now will be $1,000 in 20 years

Body Detail Greatly Improved

Shows Reveal Tendency Toward Graceful Lines, More Tasteful Colors, Better Upholstery—Higher Class Workmanship and Finish—Other Features

By George J. Mercer

IN the Palace show, to the general public the body exhibit compared favorably with any previous one. The bodies had deep cushions and thick trimming to insure comfort, the door spaces were roomy, and expensive trimming materials were used on all the best cars. Toilet cases, dome and reading lights, arm rests for the rear seats, regulators for operating the windows and frameless glass windows were common. Brilliant color schemes, showing well-painted surfaces, were the rule, the fenders were effective and of good design, the running boards had sensible shields, and extra tires, mostly carried at the rear, had strong hangers.

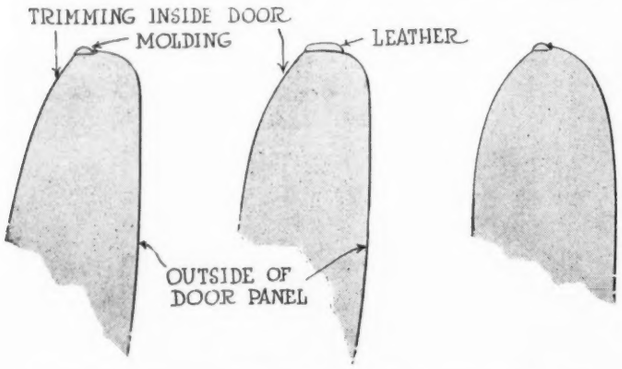
The best runabout colors shown, were yellow and black, yellow and brown, a two-tone green, two-tone gray and white and a green with white wire wheels. Touring bodies were mostly in dark colors, of the brighter shades the best were, two-tone gray, coffee and black and yellow and black.

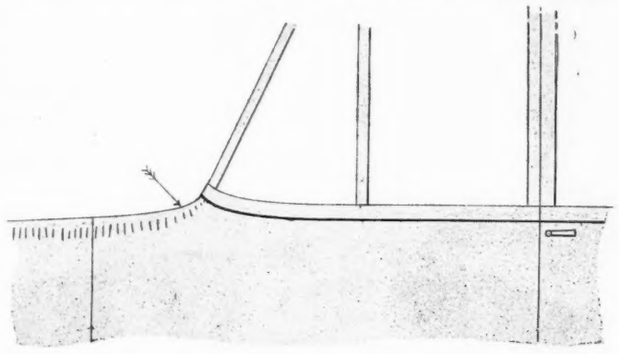
Small closed bodies showed well in blue upper and gray under and in black and gray, with guards to match the dark color. Blue and white and black and white give too sharp a contrast. The large closed bodies looked best painted in two tones of dark blue and relieved with striping. It was noticeable at both shows that striping was more common than heretofore, it is apparently coming back. Striping adds a touch of color to dark shades and is a relief that is always in good taste.

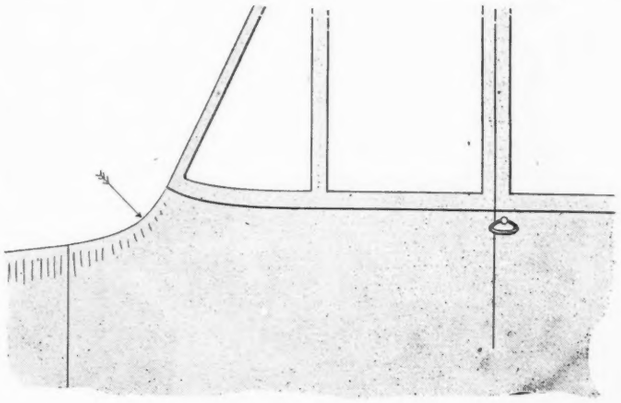
White was used to some extent on closed bodies at the Palace, but in most cases the companion color was a too severe contrast. The sedan and convertible are all-weather bodies, and it was surprising that the two-tone browns and grays were not used more generally for these, as such colors help to make the car look light, which is highly desirable for an all-season vehicle.

The trimming or upholstery is an important item in a body, more so with a closed than an open one. The latter, on account of being open to the elements, must have the substantial leather or waterproof fabrics and the choice is mainly a question of how these are assembled in the body. With the present style of flush side design for touring and runabout bodies, the large roll of trimming on top of the sides and seat back has disappeared, and the trimming finishes flush with the top edge of the panel. It is more difficult to accomplish a neat finish than formerly and careless workmanship in finishing up the leather edges at the top and around the door openings will detract a great deal from the otherwise good appearance of the body. The best finish shown is illustrated in Fig. 1 in which a metal molding covered with leather is used along the top edge, the doors and door openings being covered by a narrow welt, evenly put on and blind tacked. Fig. 2 shows a finish that does not give a neat appearance, as this small irregular shaped leather roll has a baggy look on top of the metal. Natural wood was used in a few instances and this would not be bad, if it were colored to match the paint or leather; it would then serve its purpose without advertising itself too prominently; strong contrast between the painted and rounded top edge of the body and a cap, either of wood or leather, is inharmonious and not necessary.

Fig. 3 is another sectional view of a door, illustrating the







Above—Fig. 1—Left—Best door trim finish. Fig. 2—Center—Trim which does not appear neat. Fig. 3—Right—Example of overdoing a neat trim
Right—Fig. 4—Above—Hood raised to blend into cowl. Fig. 5—Below—Undesirable result with hood not raised

same position as Figs. 1 and 2. This shows the extreme round to the top edge of the body, and portrays the carrying of a good thing too far. The round top edge is a pleasing design only when used in moderation, and the side line of the body should not be started on the curve until close to the top, while the radius should never exceed 1 in. Many bodies with not more than ¼-in. radius looked very well.

The stitched pleat for back and seat cushions was used a great deal. This is durable and makes a fine trimming design, it presents the full round appearance of the plain trimming without its defect of wearing baggy.

The trimming of the closed bodies presented a variety in color and materials, the best effects being obtained on those bodies that used soft neutral light shades of material. One beautiful design had a figure delicately outlined in the center of each panel, and the trimming design was plain with divided cushion and back, the seat and back being defined by carved wood finish. Elaborate wood finish was used on the doors and front division, the toilet cases were the visible type and of special design, as were also the handles of the regulators and the dome light, this latter projecting lower than customary. The arm holder was replaced by a silk rope hanging inside the hinge pillar. The carpet extended from the line of the bottom of the seat cushion along the sides and doors, and no cord hat-rack was used.

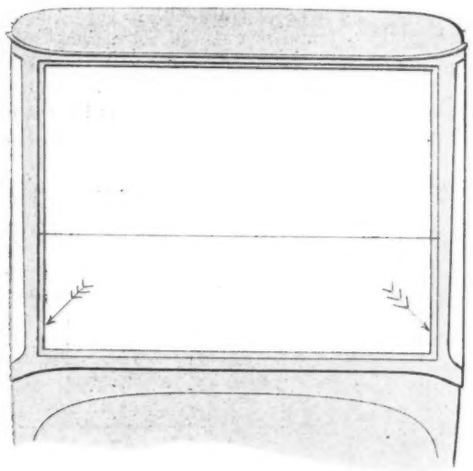
Other suitable trimming materials were those having inconspicuous figures or stripes. In some cases, the figured material was used for seat and back, the sides and roof being plain material and this made a pleasing contrast. Velours were used to some extent, and one in two shades of brown looked well. The tapestry did not look so well, the figures being usually too large to please the eye; large figures on a design for body cloth are not desirable, on account of the confined space and the tendency is to become satiated with the color display.

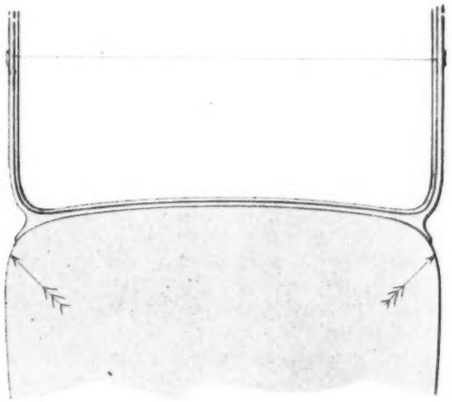
Concealed toilet cases were used largely, and the dome and reading lights were of the standard pattern on the majority of cars. The extra seats were mostly of the flush folding type. Pillar lamps were not used to any extent, and the cord hat-rack and arm holders seem to be extinct. The front division glass is now one piece and regulators are used on practically all bodies. The rear cushions generally had arm rests shaped to fit their use, without interfering with the seat room. Draped window curtains were used largely, but it is very questionable if they are likely to be continued.

A standard of style in body design is difficult to define, as any standard is to some extent local, but an exhibit as large as the Palace display, gives one an excellent opportunity to compare, and if one body looks more pleasing to the eye than another, it is feasible to dissect the difference in parts that make the one attractive and the other not so; proper, consideration, of course, must be given to the sizes that provide the necessary comfort.

Improving the Hood Lines

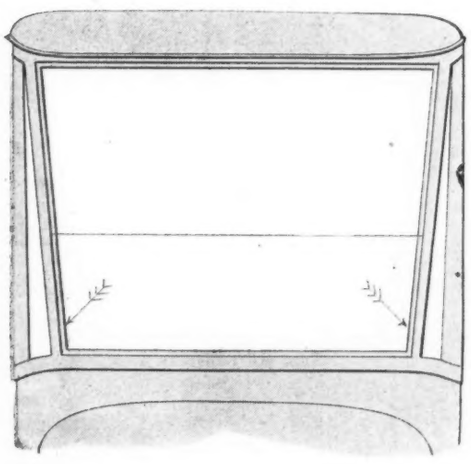
A concession to the body designer within the last year or so has been the right to alter the size of the engine hood, for without a hood that is sufficiently high and wide at the dash line, a modern body cannot be made to look well. Especially is this true of an inside-drive body of the sedan type with a slanting windshield. On this type of body the line from the radiator back must rise sufficiently, so that a continuation

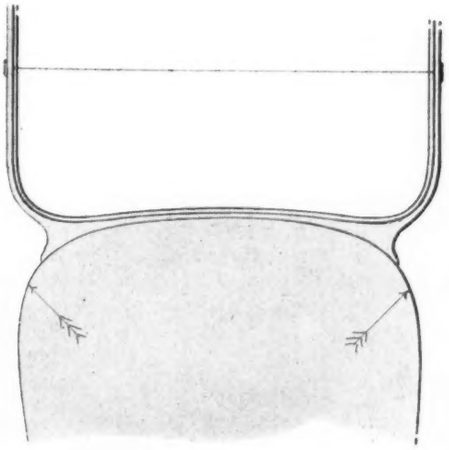




Upper left—Fig. 6—In this type of body the slanting front is kept to vertical lines at the sides with the result that the appearance is harmonious and pleasing

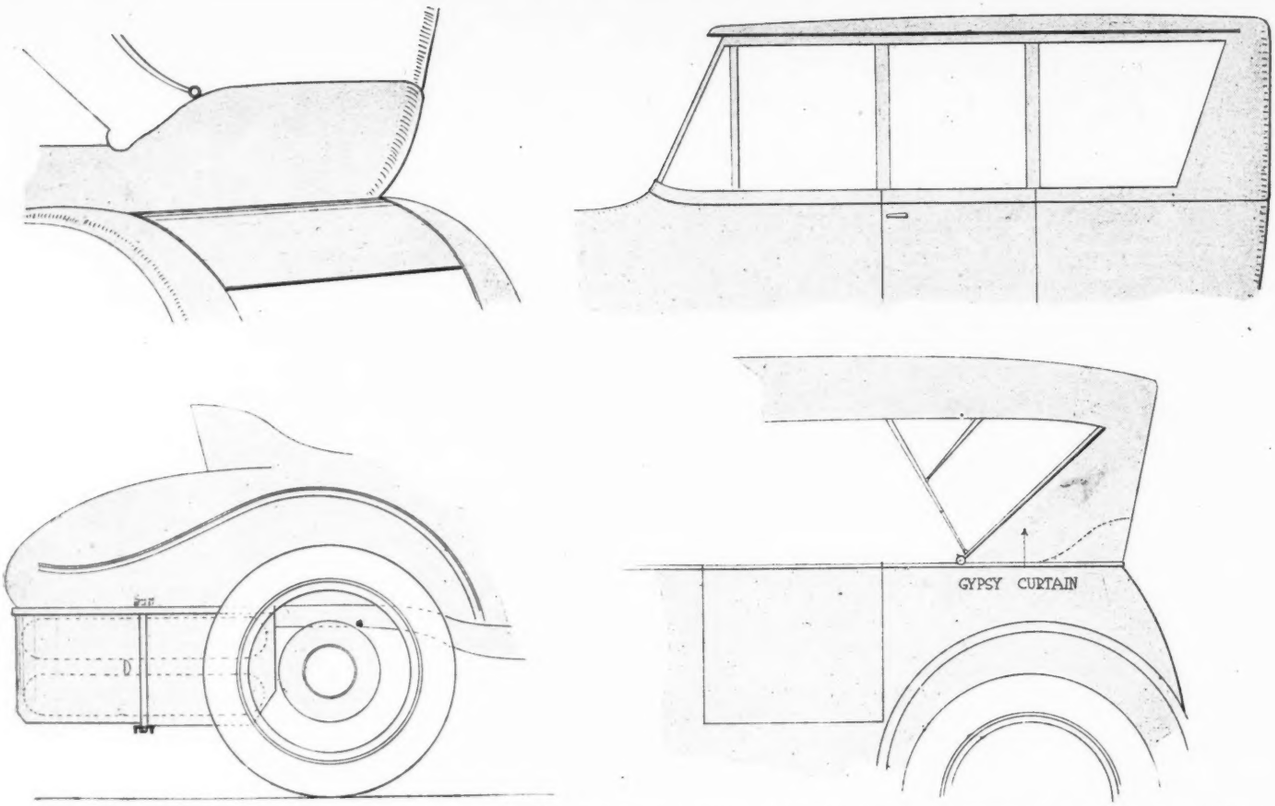
Lower left—Fig. 7—Otherwise similar to the body illustrated in Fig. 6, this type has the slanting front contracted at the top of the cowl line, producing an awkward, misfit sort of effect



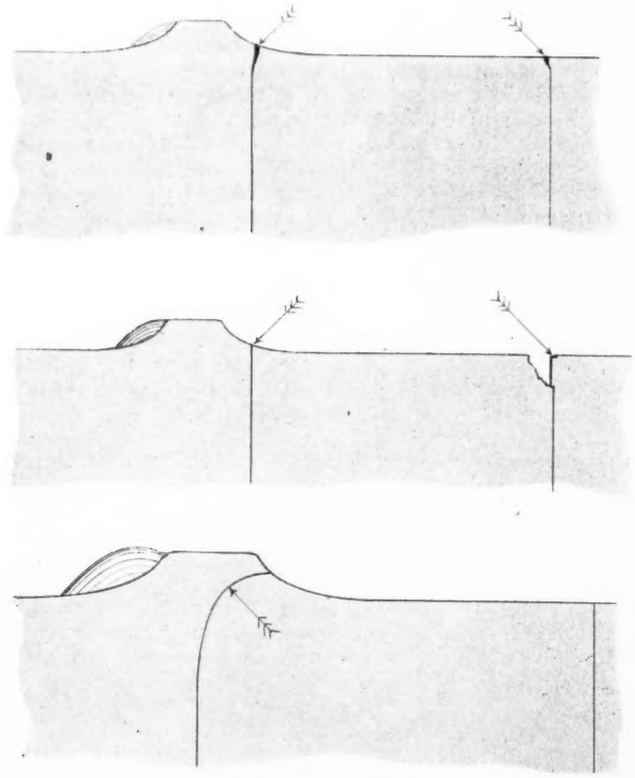


Upper right—Fig. 8—Cowl shaped with a small radius, making a simple, effective design and one which facilitates production at the factory

Lower right—Fig. 9—A case where the cowl is shaped with too wide a radius, making the windshield appear too wide for its base and also complicating manufacture by necessitating a twist in the front door, entailing both greater expense and a less satisfactory result



Upper left—Fig. 13—A well designed stern on one of the cars shown. Lower left—Fig. 14—An innovation in carrying spare tires which combines neatness with space economy. Upper right—Fig. 15—One of the latest types of convertible body, showing the flat roof lines. Lower right—Fig. 16—Use of the gypsy curtain to prevent the rear seat from interfering with the straight-line effect



Upper—Fig. 10—Example of a poor ending of an overlap door panel. Middle—Fig. 11—How some avoided the faults of Fig. 1 by cutting down the body. Lower—Fig. 12—Showing the error of using a double cowl on a short-wheelbase car. Note how it spoils the door

of this line on the cowl will meet the belt line of the body easily. If the cowl line has a sharp uptilt close to the body it will give the whole car an "up in the air" look that nothing else can overcome. Fig. 4 shows the hood raised to make the pleasing effect and Fig. 5 shows the undesirable result. This type of body shows the contrast more quickly, as the slanting front shortens the cowl, and the uptilt to meet the body must be more severe on account of being made in a shorter length. Also the best looking bodies of this class were those in which the side line of the body blended with the front in a radius just above the point indicated by arrow marks instead of meeting abruptly at an angle. Figs. 6 and 7 illustrate the front views of similar bodies; in Fig. 6 the slanting front is contracted at the bottom while in Fig. 6 the sides are parallel and the appearance is very much better than Fig. 7 in which the lines of the front are not in conformity with the side lines of the body. The idea of a contracted front is bad only when it is extreme; a moderate contraction is often necessary.

Figs. 8 and 9 are two views showing the shape of the cowl at the place of attaching the windshield. In Fig. 8 the cowl is shaped with a small radius indicated by arrow marks, whereas Fig. 9, having the larger radius, the windshield has the appearance of being too wide for the base and, in addition, this shape of cowl will necessitate having a twist or wind in the fore door at the front, making both an expensive and unmechanical construction, as well as not showing as good an appearance as Fig. 8.

Fig. 10 shows the ending of the overlap door panel. In order not to carry the overlap over the top and show an offset top line, the lap is cut off and shows an opening which, if the body had been painted in light colors, would have given the appearance of an irregular dark spot. Other bodies provided for this, as shown in Fig. 11 by cutting down on the body to permit the door lap to be even. Another form to remedy this (not illustrated), was to have the radius of the

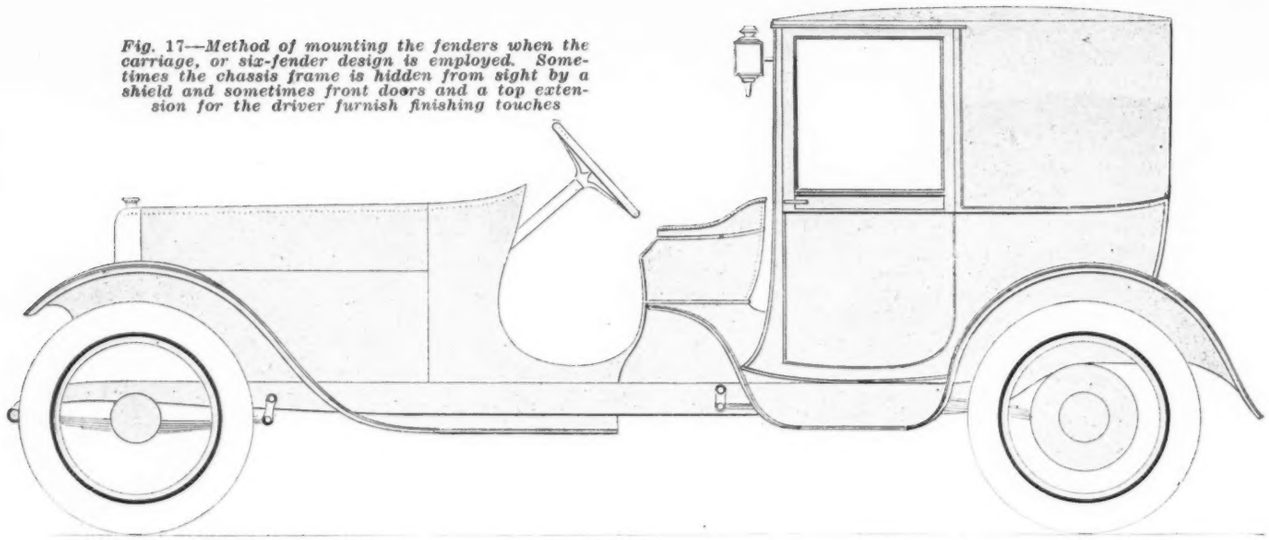


Fig. 17—Method of mounting the fenders when the carriage, or six-fender design is employed. Sometimes the chassis frame is hidden from sight by a shield and sometimes front doors and a top extension for the driver furnish finishing touches

top edge of the body very slight, in fact almost a square corner, then the door lap was cut off in line with this edge.

Fig. 12 is a section showing the second cowl when used on a short-wheelbase car, which is a very great mistake. In this case, the door has a very large piece cut off at the top front line; the hinges were also placed on the front, consequently the space was captured both for entrance and exit. The second cowl takes up room beyond the driving seat, and takes away from door space. This latter is one of the most important things in a body and no design should be considered that restricts the door opening. The use of the second cowl is also carried to an extreme on close-coupled runabouts, the disadvantage in this particular being that it carries the side line of the body *up* at the cowl and gives a higher look to the body than is necessary.

Better Stern Designs Than Formerly

There were more good looking stern ends on the runabouts and close coupled bodies than ever before. This extension beyond the seat to cover up the chassis frame, has been a makeshift proposition for a long time past, but at the Palace, there were several well shaped body ends, that were in balance with the rest of the design. Fig. 13 was a very good illustration, in which the guards were nicely attached to the sides, and looking from the side, the guard and stern had the same shape. Fig. 14 was an innovation in carrying the extra tires; the circular case below the frame revolved to permit the putting in and taking out of the tires. The case when revolved back closed the opening and there were no doors to get out of order or be in the way.

The convertible body was well represented in many of the exhibits. This design seems to have resolved itself into two types, the earlier one in which all the windows were lifted out, and the modified type, in which all the windows except the rear side one, drop flush into pockets, and the pillars lift out. On this latter the roof is flatter and makes a better looking job, Fig. 15 illustrating the latest example of this. The roof line had a very moderate drop at front and back on the majority of the bodies and the number of freak designs were few in number.

The Salon was larger in number of cars exhibited than ever before, and the greatest innovation in design was in the open bodies. The close-coupled touring body of the sporting type seems to be the trend in this design. The second cowl had few upholders and the most conspicuous feature was the continuation of the top side line of the body, either straight, or with very little raise around the back; the top meeting this line and concealing the seat top line. The best illustration was by the use of the gypsy curtain as shown in Fig. 16 wherein is also shown that the back line which extends to the chassis has the reverse direction to the customary body. The concealing of the top of the seat is also carried out on the larger bodies having extra seats. In some cases the rest for the top, when down, was located on the rear guards, when these had the upward slant at their extreme back end. On runabouts this attachment was located on the stern end.

The trimming on the open bodies was mostly plain design, without stitching or pleats, and very thick at the back. On some it did not appear to be high enough to give proper support, this criticism applying mostly to the close coupled bodies; on the regular touring bodies the trimming was stitched and the seating arrangement was excellent.

The principal effort on the part of the exhibitors, seemed to be centered on good workmanship and finish, rather than the making of changes in design. The closed body designs were extremely conservative, and the effort to rehabilitate the carriage features was very marked. The square pattern carriage pillar lamp, the square back corner of the body, the coupé pillar and driving seat of carriage design, as well as carriage fenders with steps were some things that were generally used.

Fig. 17 shows how the fenders are placed when the carriage, or six-fender design, is used. Sometimes the chassis frame is concealed by a shield, but in the majority of cases, they are as illustrated. The small town cars exhibited were exceptionally good, both in design and finish, the majority had fore doors with windshield and detachable top for the protection of the driver. This is undoubtedly the best proposition, the driver has sufficient protection when required, and the design has a completed look, which Fig. 17 lacks for an automobile. The detachable top was the regular waterproof curtain, that can be folded and put under the seat when not in use. The cabriolet was the only folding top town car exhibited, and there were two large folding top bodies, that worked easily and folded low when down. The convertible body also had its place on the line. It was noticeable that the flapper was rarely used on bodies at this exhibit, whereas at the Palace, flappers were used exclusively on convertible and falling top bodies.

Door Pillars Lighter on Closed Cars

One pleasing feature at the Salon was the lighter door pillars on closed bodies, that heavy appearance of pillar thickness when the door is open, having been replaced by proportions resembling the carriage door, and the garnish molding inside has become the modest old-fashioned size. Also quite

a number of the extra seats did not fold into pockets, but were visible, against the partition. This has become necessary because the division light is required to fold down flush. The division is made straight, and additional knee room is obtained for the occupants of the extra seats, without having the body any longer. The roofs were made as light looking as possible with the dip front and back very moderate, and leather was used for covering on the majority shown. A number of V-front bodies were at this show, and on all models the single upper glass only was used. The V-front has the disadvantage of not protecting the driver when the two upper glasses are open, as the angle of the front carries both sides away from the center at the bottom, resulting in a wedge-shaped space in the center, which neither glass protects. It makes an attractive looking design, but has had a stubborn fight to attain popular favor. An early experience in the use of the V front was that the glass reflected the side lights from the street, but this has been overcome by tilting the glass back out of the perpendicular about 3 deg.

The doors on many of the bodies had molding and the fenders were, with the exception of those bodies using the six-fender design, of the smooth top type and crowned about 1½ in. with narrow skirts set in beyond the edge beading.

Some of the six-fender designs were shaped to imitate the effect of the leather fender.

The trimming materials used were principally the medium light colors. Many were plain and some were relieved by inconspicuous figures or stripes of a darker shade. One very beautiful material was an almost white background with blue spot figures, the other appointments corresponding in color. Many of the toilet cases were elaborate in shape and with inlaid work, and they were all of the visible type. A large proportion of the closed bodies were trimmed plain without stitching or pleats and with the cushions and backs divided, making three places defined by a line through the cushion and back. Even when the cushions and backs were stitched or had the pipe and point, the balance of the trimming was never elaborate, the doors had a panel effect with cord, to relieve the plainness, and some had pockets, though the majority were without. Roller curtains were the rule, no arm holders or hat racks and very little wood finish on the doors and front, The metal appointments were sterling silver and nickel.

The dome lights were of different design than customary, and in many cases extended lower, also the corner reading lights were more prominently placed on many bodies and were, in a few instances, of the hanging type. The speaking tube was generally used, and a good idea was developed on some of placing the horn for the driver under the cowl, out of sight and, as the open end faced back, the extra distance that the horn is placed away from the driver, is compensated for by there being no wind resistance against it.

The painting was principally dark blues, greens and blacks; a few combined two colors, one light and one dark, but all color schemes were good and striping was generous.

New Colonial Eight Engine Is Compact

A NEW stock eight-cylinder engine is being marketed by the Colonial Motors Co. of Detroit. It is a conventional type of V-engine and has been under development for the past 2 years. A horsepower output on the dynamometer of 62.5 at 2500 r.p.m. is claimed and the manufacturers state the weight as 496¾ lb. It is a compact design and is particularly featured by the small space it takes up beneath the engine hood.

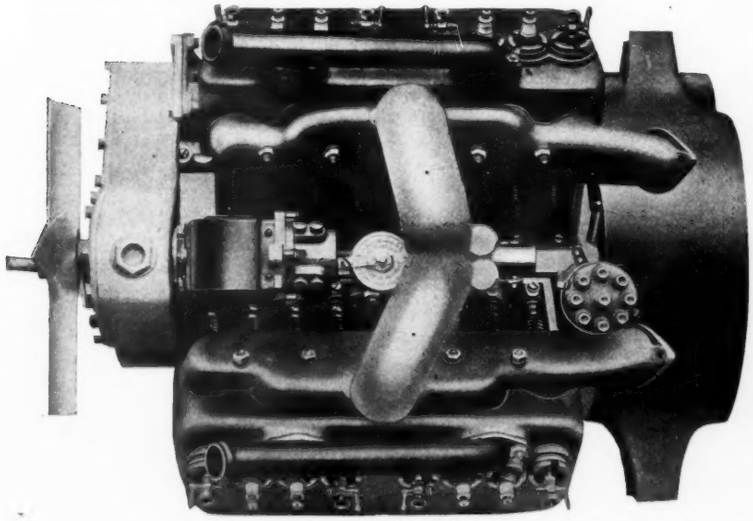
In accordance with usual V-engine design where side-by-side rods are used, the cylinders are staggered 1¼ in. The engine is an L-head with the cylinders cast in blocks of four. Bore and stroke are 3 by 5 in. The crankcase is a single aluminum casting and includes the bell housing within which any standard clutch can be housed.

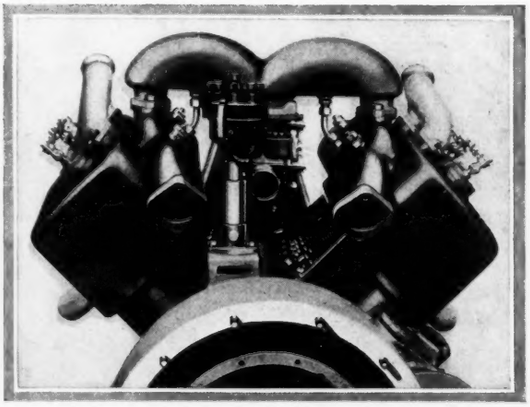
The intake is aluminum and is hot air jacketed to prevent the condensation of the fuel and to actually assist in the complete vaporization of the incoming charge. Cooling is by thermo syphon and with the short engine block considerable space has been found to provide ample waterjacketing space. The length over all is 32 in. Of this 19 in. is taken up by the cylinder block. The extreme width of the engine is 25 in.

The camshaft, magneto shaft and fan shaft are all driven by silent chains which can be adjusted from the outside while the engine is running. The valves have a diameter of 1½ in. in the clear and a lift of 5/16 in. They are offset at an angle of 7 deg. to secure direct contact on the camshaft without the use of intermediate linkage.

No external leads are used in connection with the oiling system. This is a pressure feed through a hollow crankshaft. The bearing dimensions on the crankshaft are 1⅞ in. by 3 in. for the front; 1 15/16 by 1¾ in. for the center, and 2 by 3⅞ in. for the rear. The connecting-rod bearings are 2 in. diameter and 1¼ in. long. The camshaft is also carried on three liberal bearings.

As will be seen from the illustrations there is a simple layout of accessories. These are incorporated in the V, for the larger part and the valves are accessible for adjustment by removing a plate within the center of the cylinder casting.





Two views of the new eight-cylinder Colonial engine. It has a bore of 3 in. and a stroke of 5, and is said to deliver an output of 62.5 hp. on the dynamometer at 2500 r.p.m.

Foreign Trade Department

Addresses at N. A. C. C. Export Conference

THE AUTOMOBILE this week presents herewith several of the papers presented at the convention of automobile export men conducted by the National Automobile Chamber of Commerce, Friday, Jan. 12. In our report of this convention last week attention was drawn to the difference of opinion among U. S. A. manufacturers as to whether we should sell the foreigner our automobile as built for home consumption or whether we should alter it to meet the wishes of the foreigner. The arguments of E. W. Davenport favoring selling our car as it exists to-day are set forth in his paper which is among those printed herewith.

Chas. Denby, export manager for Hupp, drew attention to the possibilities of the great Chinese field, a field he considers one of the most attractive for American export work.

Troubles in connection with shipping are well outlined in the paper of L. V. Hummel, traffic manager of Gaston, Williams & Wigmore.

R. J. Archer, export department of Willys-Overland Co., has tackled the problem of the necessary factory organization for handling export work. He deals with the subject as to whether it is best to have the export department at the factory or located in New York City, where it is close to those concerns handling shipping, marine insurance, etc.

Dr. E. E. Pratt of the Bureau of Foreign and Domestic Commerce in his paper drew attention to the value in any industry of export trade. It has a decided stabilizing influence.

U. S. A. Cars Should Win Abroad on Own Merits

By Charles Denby

Export Manager, Hupp Motor Car Corp.

TO the casual observer it would seem that the question, "What is the best method of entering foreign markets?" could be answered readily by giving details of transportation and financing for the guidance of the inquirer. But we in the export trade know better. We know that this is a subject which engages the attention of many thousands of our fellow citizens daily; a problem upon the solution of which we base our hopes for foreign trade.

Deeper Understanding Required

The problem of how to obtain a footing in foreign markets for articles of American manufacture, in fact, engages the attention of American manufacturers more and more as the home consumption of our raw materials increases and we are more and more driven to look abroad for gain. The American merchant is apt, however, to regard the foreign market, in a general sense, as a natural phenomenon, and he is inclined to consider the problem of approach to it as one to be solved under the broad laws of supply and demand. A not very profound consideration will show that we manufacturers of automobiles require a deeper understanding of foreign countries as markets; that our investigation must be pushed farther than the question, "Is there a demand for my goods in such a market?" The demand itself must be analyzed and all the elements which give rise to it must receive the most careful attention, in order to arrive at a sound conclusion as to the best methods of introducing automobiles in any foreign country.

In the automobile trade we meet a variety of conditions: we meet with competition on the part of foreign factories; competition on the part of manufacturers of our own nationality; we meet a variety of tastes, a wide range of physical conditions, national prejudices, labor problems, legal obstacles. What, then, in general, is the best method for American automobiles to enter foreign markets? And what, to bring the question down to each one of us individually, is the best method for my automobile to enter foreign markets against the difficulties of that market; against the foreign competitors we will meet there, and against the perhaps more dangerous competition which we will meet with from one another?

A part of this investigation we export managers can make together, assured that identity of interests will bring no conflict. We can consider foreign markets, in fact, side by side. It is possible that at a certain point we will begin to part company. We of the Hupmobile may find that we fear you of the Dodge; of the Studebaker; of the Chevrolet; of the Maxwell, Chalmers, etc., and the many other makers of American cars, who feel, as confidently as we do, that the foreign market is your proper goal. I think, however, we will gain more than we will lose by an exchange of views. Let us see whether, as Americans, not as representatives of particular factories, we cannot reach such a common ground, on which we can stand together and find that we can better face the foreign market united than divided.

Three Men Involved

The Chinese have a proverb: "San jen tung hsin hwang tucheng chin," which means that if three men are of one mind their efforts may turn yellow earth into gold. There are in all factories three men in the problem whom we must unite to reach its solution. These are: the technical man who designs our machine; the financier who backs it; the salesman who sells it. If we could unite these men in our various factories, working as a unit for the whole trade, we could almost carry out the Chinese proverb and turn the yellow earth of foreign markets into gold for American dividends.

These are the three main elements in the export of automo-

biles: the building of a car that will suit the foreign buyer; the credit which will enable him to finance his purchase, and the salesmanship that will make him willing to purchase.

Considering, in the first instance, foreign markets in general, we have said before that the general form of our problem is: "Is there a demand for my goods in such a market?" Now, the easiest form of a demand to meet is that of a commodity already in use, and the easiest way to supply it is to sell the commodity for less than the present consumers are paying for the identical thing. If an automobile manufacturer in America can learn of a field where buyers pay for an automobile such as he manufactures more than the price at which he can deliver it his problem is free of difficulties. All he has to do is to produce his car and arrange for its transport and sale. If I can find a market where they use four-cylinder gasoline cars, painted blue, weighing 2800 lb. and selling for more than the Hupmobile would cost delivered there, all I have to do is to tell my factory to make them, tell my traffic manager to ship them, and engage an agent on the other side to market them.

Unfortunately, we do not find any market so ready made. In general, for manufactured articles in the foreign market, adaptation must be made to meet the exact wishes of the foreign buyer in order to secure a foothold. The manufacturer sometimes makes an article adapted to American consumers which he thinks should find a ready sale abroad, though not identical with what people are using there. He is almost certain to find that in style his article is not what the foreign buyer wants; that it is perhaps better than the foreign article; that it is so made as to necessarily cost more than the foreign buyer is accustomed to pay, etc., etc. To these conditions he must adapt his campaign.

Automobile Problem Different

Our automobile problem is slightly different from that which confronts the general exporter. We find that American automobiles are generally cheaper than those sold abroad and that the foreign prospect is inclined to doubt whether a Yankee machine at the price at which it is sold can compare in serviceability with the higher-priced machine which he is accustomed to buying.

Here arises one of the great export problems: Shall we try to convince the foreigners that we can make, in American factories, a machine of our model as good as is made in the factories of Birmingham, Turin or Paris, and sell it to them cheaper than their adjacent factories can produce the same model? Or shall we devote our efforts to attempting to produce an automobile for export closely following European models, a departure from our own ideas, a special export job? To this I have but one answer—No. Let us rather develop an American model combining the best that we can find everywhere. Let us try to win by our own ingenuity, by our price, by our quality—not by imitation.

In most markets, particularly in Europe, we do not have to teach people to use and to appreciate automobiles. All we have to teach them is that American machines, at cheaper prices, give just as great service as expensive foreign makes. This is the task for the advertiser and for the salesman, and this, as I have said, is the greatest field for American foreign trade extension. In these markets, however, we are met with difficulties. We have to fear not only the dangers of a domestic combination against us, and appeals to the buying public to patronize home industries as an act of patriotism, but we have also to fear the possible erection of hostile tariffs and possible administrative difficulties created by the foreign governments, who will wish to protect their own manufacturers.

Patriotism in Purchases

All export managers are familiar with the advertisements of English tires now running in British trade papers, which show us how the "patriotism in purchases" cry can be used, and it must be admitted that this is a strong appeal. It can be met only to a certain extent by difference in prices as long as protective tariffs do not intervene, and by an attempt, as far as possible, to domesticate our business, so to speak, to make it seem less foreign. To this end, a careful campaign should be conducted by all American manufacturers, accompanied by the most discreet salesmanship and advertising. We must attempt, as far as possible, to give a local character to our business. We must convince the people that foreigners associated with us abroad benefit by our success; that, while we manufacture our goods largely in America, the profits on the trade are widespread; that we are not actuated by purely selfish motives, and that a great industry is of value to a country, even if its seat is in another land.

This matter must, of course, be handled in each market in a different way, but as a general principle we should select as our representatives abroad men familiar with the markets, men whose temperaments will tend to encourage good-will rather than hostility, and we should avoid the aggressive tone of American advertising, which may not appeal to the foreign consumer in many markets. If a tariff barrier is created against us our only redress will be to invoke the action of our own Government.

As to this I make no suggestion; but it is evident that as export trade depends more on exchange of commodities than upon remittance of money, we can influence foreigners to let us into their markets better if they see that this right obtains a reciprocal advantage in our own, and also if they realize that prohibitive tariffs may work both ways.

The language in which foreign trade is to be conducted is an important consideration. It is evident that we cannot use English everywhere. This is going to be particularly true after the war. The language in which our advertisements are run should be carefully chosen to win the highest approval of the journals where printed. The language of our circulars should be adapted to meet local prejudices, and it need not be insisted upon that many at least of our salesmen should have a command of the languages of the countries in which they do business. In fact, I think it a wise measure to use local salesmen, as far as possible, in subordinate positions at least.

Must Create Markets

The point I wish to emphasize in the class of markets of which I have so far spoken is that we do not have to educate the people to the use of our article. There is another kind of market to which we Americans, under the spell of the ready-made markets of the world, are not accustomed to pay sufficient attention, viz.: those markets in which a demand not now existing may be created and then supplied. This applies at present on a large scale to only such trade markets as Russia and China and parts of South America. There, in wide areas, we must not only introduce our automobiles, but we must accustom the people to their use in order to sell them. This is particularly true of China. Think what it would be if we could get the Chinese Empire, with its millions of square miles of territory and its hundreds of millions of people, to widen their communications, to build motor roads and to take from their hiding places the hoards of silver and buy automobiles therewith. We would have a market there not less than that of the United States, and I believe the day is coming when we will have such a market. At present there are no roads in China except a very few scores of miles in the cities of Shanghai, Tientsin, Peking and Hankow. The age of highways is coming in Asia, as it has come with us, and we American automobile manufacturers should be farsighted enough to put our shoulders to the wheel and to push on the highway movement in China with something like the zeal with which we are pushing the Lincoln and the Dixie highways in the United States.

This is not an idle dream. If we turn to another world-wide American industry we find that the dreams in its line have been made true by intelligence and zeal. The American Tobacco Co. some years ago found millions of smokers of tobacco in China, but no smokers of the cigarette. They made up their minds to revolutionize the habits of these millions. They started great cigarette factories in Shanghai, in Manchuria and in other parts of the Empire, and in less than two decades they have converted the Chinese from the pipe to the cigarette, until the American Tobacco Co.'s marks are familiar in every city, village and hamlet of the Empire and its business has become one of the most gigantic enterprises of the world. Our dream of a China converted to the use of automobiles is perhaps a nobler goal.

Develop Far East Market

This is one point which I wish particularly to emphasize in this short address—the advisability of attention to the undeveloped markets of the Far East. We talk much about war conditions; about the extent to which our prosperity depends on the war's continuance; about the possible commercial collapse which is to follow the re-establishment of peace; and about the steps of preparedness that we should take for this eventuality. In this preparedness let us automobile manufacturers not forget the great neutral market of China, where a little foresight can lay the foundations of a great future, where we do not come into conflict with tariffs addressed more against ourselves than against others; a market which a consistent policy of good-will has made friendly to Americans. I tell you that the good-will of the Chinese market toward American manufacturers to-day is a gigantic asset that it remains for our manufacturers to convert into cash. If we do not so convert it, it will disappear gradually under the more careful attention of the Englishman, the Japanese, the German and the Russian. Now is our chance. A little money judiciously spent in China to-day in the fostering of the automobile trade will go farther toward bringing results than 100 times that money spent in any of the allied lands.

There is often doubt expressed as to whether trade follows the flag. Let me enunciate this principle: "Trade and the flag both follow the dollar." In those markets in which you invest you will sell goods.

I have quoted above the Chinese proverb that three men of one mind can turn yellow earth into gold. If we urge on our engineer to perfect the good work which he has already begun and make the American automobile a typical American product as good as any that is made abroad, and at the same time cheaper; if we can induce our financial backer not only to extend the credits which we need in foreign markets, but to finance our efforts there, I think we can rely on the American salesman to bring our enterprise to success. "The American automobile with the American dollar and the American salesman behind it" is the slogan which will take our automobiles into all corners of the earth.

Must Realize Value of Our Own Products

By E. W. Davenport

Export Manager, Maxwell Motor Co.

PROMINENT men and delegations returning from tours of investigation, as well as individuals of long experience outside of the United States, all tells us that the only way to develop our export automobile business is to give the foreigners what they want in the way they want it.

The European automobile man gives all sorts of options in specifications, long-term credit, etc.; therefore we must do likewise. Probably each of us has repeatedly fought with his production department for certain special features that some of his foreign dealers have convinced him were absolutely essential.

All of this is beginning to indicate that we are allowing our foreign friends to sell their point of view to us without our fully appreciating the value of our own proposition. Manufacturing, selling and financial conditions in the different European countries have been very different from those existing here in the U. S. A., and it is only natural that export customs and methods to suit home conditions should be developed by those countries particularly interested in foreign trade. Our importing friends, used to these methods, familiar with no others, and constitutionally disliking to make changes, convince us that it is to our advantage to do as they say—in other words, they have sold us their proposition.

Our whole automobile industry is based on standardization, by which are produced large quantities of cars, all practically alike and each one carrying a comparatively small overhead expense and profit. This standardization has enabled us to give automobile value far exceeding anything any European manufacturer ever gave; value that the European is beginning to appreciate and that he is worrying about.

Do we as export men fully realize the value of the propositions we have to sell? Have we analyzed them and found out for ourselves just how far we can encroach on our practice of standardization without defeating our own ends? How far can we allow our overseas dealers to sell to us the methods of the European manufacturers to be used in connection with our own manufacturing and selling methods?

Aside from furnishing right-hand drive, I believe that the nearer we can keep to our standard car the better it will be for all concerned. Conditions in some of our factories may allow of our standardizing some features on our export models, and some makers selling higher-priced cars may be able to allow limited options without interfering with production.

Educate Natives to U. S. A. Methods

In general, however, we are going absolutely in the wrong direction when we turn away from the ideas and methods in which we are the strongest. I do not mean that we should attempt to stuff our ways and products down the throats of our foreign friends, but we should show them that by following our methods and using our regular product they can satisfy more customers and make more money than by handling a built-to-order car.

I want to mention the experience of a certain overseas dealer handling very successfully two American cars. On the higher-priced car a variety of options can be obtained from the factory; practically none can be had on the lower-priced one. The dealer, on the other hand, gives to his customers on both cars any colors, almost any make of tires, a variety of equipment; in fact, caters to the personal taste of those who want a made-to-order car. However, all of his cars, both high and low price, excepting only the closed bodies, are now ordered from the factories on monthly schedules and all to standard specifications. What changes are called for he attends to after the cars arrive.

Formerly he booked orders and specifications for the more expensive car, sent them to the factory and made his customers wait sometimes 6 or 7 months for their cars. He sold the small car at first just as it came from the factory, and found that his ability to make prompt deliveries, or sales to arrive on a definite steamer, was taking business away from the large car, on which there was considerable profit. He was enough of a thinker to work out for himself the idea that if he made arrangements to do the special work he had been asking the factory to do it would not cost him much more than he had been paying, and the advantages accruing, he thought, would offset any extra expense.

In practice it worked out much better than he expected. His dealings with the factory were greatly simplified. He could often take orders away from competitors because of the delivery of a car from stock, or to arrive, in the definite 2 or 3 weeks required for him to get it in shape, as against the indefinite 5 or 6 months necessary for his competitor to have the car built and shipped from the factory.

Having arrangements for special work on the large cars, he found he could also give special features on the highly standardized small cars, letting the owner purchase his made-to-order combination at little more than the price of a standardized car.

In the case of this particular dealer it has taken some time and serious thought to work out for himself the plans and details that should have been handed to him ready for application; plans by which his customers can have the price and interchangeability benefits of our methods of manufacture, and at the same time some European made-to-order features.

This combination, properly developed as to detail for different conditions and localities, is, I maintain, absolutely unbeatable. It is up to us to work this out, each on his own proposition, and present it in such a convincing way that the dealer will realize how much it is to his disadvantage to throw the combination out of balance. We must not let him feel that we are arbitrarily turning him down when we cannot grant a request of his. We must make him understand that he is setting our manufacturing department back one step and himself two when he gets us to do something that he is better fitted to do himself. A dealer with enough ability as a salesman can perhaps make us feel as though his problems were the only ones and that we should give him what he asks for. It is in these cases that we must exert ourselves, not only to keep but to impart to the dealer the proper perspective.

The point of view of our traveling men must also be given continual attention, both for their benefit and ours. It takes a very strong-minded, level-headed man to keep home conditions uppermost in mind during a long trip. He is bombarded with every sort of argument by every sort of dealer in an effort to get him to grant concessions and to do business according to methods which may not fit in with ours. The man himself is usually chosen to go into a territory on account of his familiarity with it and the people, and he may have a natural leaning their way. It is, therefore, only natural for a man, after having been away for months, to drift into the attitude of representing the dealers to the factory, instead of the factory to the dealers. We must keep in as close touch as possible with him so as to postpone this frame of mind and get him back as soon as it does appear. With it no man can properly sell his proposition, nor can he aid us to keep the combination of methods which go to make our proposition accurately balanced.

Close Study and Co-Operation Export Necessities

By R. J. Archer

Export Department, Willys-Overland, Inc.

THERE are two ways in which an American manufacturing company can obtain export business. The exporting house offers the first and easiest way, as the manufacturers will be without much concern for details of handling. The export house, with its clientele abroad, will secure orders and after receipt of goods at American seaboard will attend to the somewhat complex business of forwarding.

The subject of this paper, however, requires that the second way be given detailed comment.

Foreign sales in particular require direct and close supervision, and the average export house, while usually well equipped to handle shipping and financing, does not always come up to the hopes of the manufacturer so far as sales are concerned. This applies more especially to automobiles, which, as a highly specialized article, require special sales methods by trained men to obtain maximum results.

The peculiar requirements of export trade demand that automobile manufacturers desiring direct connections have a separate and distinct department which will be equipped to handle all requirements in a way that will insure smooth running. It will be useless for them to believe that their domestic force can have sufficient knowledge to handle foreign business.

Export Department Not Separate Unit

This export department, while specializing, must nevertheless be a component of the whole organization. It is too vitally interested in and dependent upon domestic departments to be entirely segregated. House policies, together with American methods of selling and advertising automobiles, are very important factors and must be kept constantly in touch with, even though they may have to be moderated before application abroad. The export department may be considered the medium by which the producer and the customer are kept in comparatively close contact.

The situation of this department, dependent as it is upon other links of the organization chain, can possibly be located at company headquarters to the best advantage. If the main office of the manufacturing company is outside of New York a small subsidiary office should be had near Wall Street, by which ocean freight, marine insurance and shipping documents can be properly taken care of.

Export Manager's Qualifications

The export manager should be a man thoroughly conversant with foreign merchandising methods, who has been broadened by contact with European export business tactics, for the British and Continental people are past masters in the game. He should have the comparative factors of export business at his finger tips, so that his perspective of all matters may be correct. He should be of a caliber to realize that his export work in automobiles must move hand in hand with domestic production and policies. Give-and-take methods are vital in these days, when the companies are making the bulk of their profit here in America.

High officials of the company should take an occasional trip abroad to more thoroughly appreciate what the export manager is contending with. There must be confidence and harmony between the domestic and export sections.

The export manager should attend all company meetings which might have bearing on his work, also any held by associations directly interested in the expansion of foreign trade. Co-operation of manufacturers, with subsequent intelligent and prompt assistance on the part of the United States Government, must be had if America is to retain her grip as a large exporting nation.

An export office, equipped as it should be to handle the great variety of detail necessary to its successful efficiency, is, in size, naturally subject to the volume of business done.

Every responsible man in the department should not be pressed with detail to the point where he cannot have time to think. A few more junior clerks cost little and are available to step into higher positions in case of necessity. Export problems, with the present bad shipping conditions, require clear heads, and a man all bound up in routine is poor material at any time.

The gathering of an experienced staff in these days of demand for export men offers no little difficulty. Clerks should be of high intelligence and receive higher wages.

Co-operation among members of the staff must be absolute. Friction in a department costs money, as it does in machinery, and offenders in this respect should not be tolerated.

The manager should arrange meetings at least once a fortnight, when topics of a common interest can be discussed.

Every member of the department should consider taking a course in foreign trade as issued by the Business Training Corporation of New York. The cost of $30 would be well spent.

The detail of the department can be divided into sections, each section having a head reporting to the manager or his assistant.

Automobile exports have to do with the following:

1. **Contract.**
   - Allotment of territory.
   - Encroachments.
   - Contracts.
   - Enquiries.
2. **Car Order.**
   - Production.
   - Orders.
   - Space engagements.
   - Shipping.
   - Prices.
   - Records.
3. **Parts.**
   - Orders.
   - Shipping.
   - Prices.
   - Records.
4. **Service.**
   - Claims.
   - Complaints.
   - Mechanics abroad.
5. **Advertising.**
   - Appropriations.
   - Catalogues.
   - Newspaper or other copy.
   - Records.
   - Circular Letters.
6. **Finance.**
   - Insurance.
   - Credits.
   - Billing.
   - Documents.
7. **Statistical.**
   - Factory Representative reports.
   - Reports on commercial conditions.
   - Maps.
   - Mail outward.
8. **Cable.**
   - Making of private codes.
   - Cables and telegrams.

In looking over these divisions and their main work a great similarity to domestic departments will be noticed. The work of both have certain features which are in common, and location of the export department in the home office to obtain domestic precedent is quite often required.

The translation of foreign correspondence, inward and outward, as well as all advertising matter, can be more economically taken care of if a portion of the regular staff is composed of men having thorough familiarity with certain foreign languages. The extra time of these men can be taken up in ordinary clerical work.

It will probably be found that a check on all catalogue work will be required and can be had without extra cost by the printing company which specializes in this class of work.

The manager should keep personally in touch with factory representative reports and correspond freely with each man. Nothing is quite so disheartening to a salesman in foreign territory as to be neglected in this respect.

While in the above a brief outline has been given, many details of department organization must necessarily be governed by circumstances and would be arranged by the department manager.

It is believed that co-operation among the export managers of the companies having membership in this association can occur to the general good of all concerned, and the export department of the Willys-Overland, Inc., stands prepared to do anything consistent that may further this aim.

All automobile companies engaged in shipping abroad will meet with the strongest kind of competition from Europe after the end of the war, and preparedness in America among us now will later on bear valuable fruit for the trade of America in general and of automobile companies in particular.

World's Markets Ours If Properly Developed

By Dr. E E. Pratt

Chief of the United States Bureau of Foreign and Domestic Commerce

THERE are some very specific and some very good reasons why automobile manufacturers should be interested in foreign trade. The first, and perhaps the most important, reason is that the foreign market in itself is a very large market. I estimate that outside of the principal producing countries—that is, France, Germany, Italy and Great Britain—there are approximately $60,000,000 worth of automobiles imported every year. In the last normal year before the outbreak of the war exports were:

France exported over $45,000,000 worth of automobiles; Germany exported about $20,000,000 worth of automobiles.

Great Britain exported about $15,000,000 worth; Italy exported about $5,000,000 worth of automobiles.

In the same year, 1913, we exported $27,000,000 worth.

Export trade will tend to stabilize conditions in the United States. In many lines of industry, the prosperity of the business is dependent upon factors entirely outside its control. A short crop or a bumper crop may entirely determine the output of an industry. This is, to a certain extent, true of the automobile industry. If, however, the manufacturer has a business which covers the entire world, a poor crop or bad business conditions in one country will be offset by good conditions and prosperous times in another country.

A well developed export trade will, to some extent, do away with seasons in the manufacturing end of business.

There are certain main factors to be taken into consideration in studying a possible foreign market for automobiles. The first matter to be considered is the extent and character of the purchasing public. The most important facts that can be obtained with reference to any foreign market are those that can be obtained and that can only be obtained by actually visiting that country. Every manufacturer who expects to export automobiles should in person or through a responsible representative visit those markets in which he expects to specialize. Other factors which should be considered in determining the purchasing power of a market are the distribution of population as between city and country; the character of the population in countries where there is a dual population; the distribution of wealth—whether it is highly concentrated among a few wealthy individuals, or is generally distributed throughout the community. Interesting facts with reference to purchasing power and incomes can be obtained in those countries which have adopted the income tax. The imports and exports of cars also form an index, especially where the average value of the cars imported can be obtained.

The second point of importance in studying a foreign market is, whether or not there are useable roads in that country. The third important point is whether or not fuel and oil can be easily and universally obtained.

What are the possible foreign markets for automobiles? Perhaps at the present moment the most helpful classification which could be made of markets without going into too great detail would be to divide them into three groups:

1—Belligerent countries, 2—Colonies, 3—Neutral countries.

1—It is a fair assumption that whatever conditions affecting the sale of automobiles may be, for some time after the termination of the war there will be a considerable demand for American cars during the reconstruction period, even in the automobile manufacturing countries like Germany, France, the United Kingdom, Italy, and Belgium. The character of the demand may, however, differ from what it was before the war. Attention will probably be concentrated largely on the commercial and industrial vehicles rather than on those used for pleasure.

2—Among the best markets for American automobiles prior to the war were the British Colonies. In the fiscal year 1914, about 40 per cent of our exports of passenger cars went to Canada, Austrialia, New Zealand and the Union of South Africa. Considering the fact that in all those colonies, with the exception of New Zealand, preferential reductions

(*Continued on page* 224)

Packard Aviation Engine 4 by 6

Follows Lines of Small Design — 200 Hp. at 2180 R. P. M.—Electric Starting—Battery or Magneto Ignition

THE Packard Motor Car Co. has been concentrating a great deal of effort in the development of a twelve-cylinder engine for aeroplane and airship purposes. The facilities offered in the Packard experimental department, with every instrument necessary for development work, have been employed for nearly 2 years in the development of this new aircraft motor.

Packard, however, is not yet able to announce a price nor dates of deliveries, and cannot do so until final decisions are made on several details of construction now undergoing tests. These experiments will determine the final details, and thus the price. Laboratory work now going on will settle these points within a few weeks, when more definite statements will be available. This firm is only interested in aircraft engines, and does not plan the building of planes, but rather intends to limit its efforts to the production of twin-six engines.

Twin Six with Overhead Valves

The Packard aircraft engine is of twin-six design, V-type, with overhead valves and with the cylinders set at an included angle of 40 deg. to eliminate head resistance. The engine is rated at 200 hp. at 2180 r.p.m. The bore of the engine is 4 in. and the stroke 6 in., giving a total piston displacement of 904.8 cu. in. The engine is complete with Bijur starting motor and generator, and is fitted with two-point ignition.

The cylinders are built up of alloy steel, in blocks of three. The cylinder barrels are separately bored from solid forgings, machined outside and inside, and with attached water-jackets extending down to a point lower than is customary in automobile practice. The entire block of three cylinders with jackets weighs approximately 40 lb.

The three-ring pistons are of aluminum alloy, with exceptionally large wearing surface, and the connecting-rods are of I-beam section, machined all over. Forked-type rods are used on account of the saving in length and total weight. With an L-head motor, the length of the block is determined by the valve sizes, which allow space for side-by-side rods. In overhead-valve construction for aircraft work where quietness is not a primal aim of design, the connecting-rods are the limiting length factor. For this reason forked-type rods are used with the overhead-valve aircraft design.

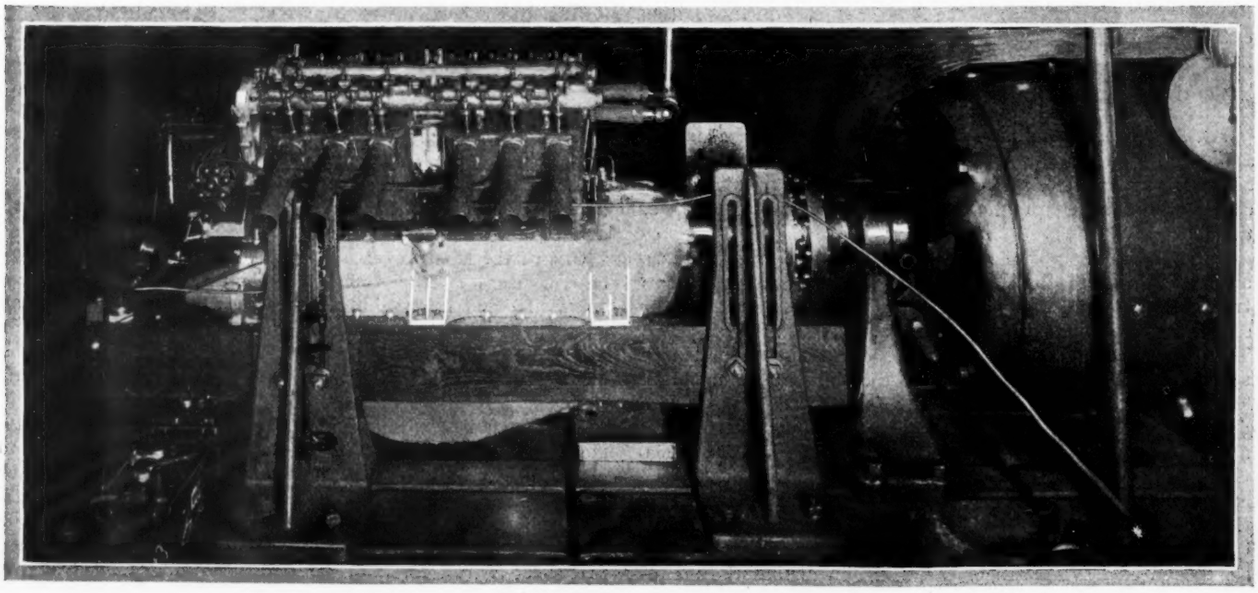
The crankshaft is made from high carbon steel, drop-forged, heat-treated, and machined all over. Three main bearings are used and all bearings are 2¾ in. diameter. The front main bearing is 4½ in. long; the center bearing, 3½; the rear bearing, 2¾; while the crankpin bearing lengths are all 2⅞ in. The crankshaft is drilled out for lightness, and weighs complete, approximately 100 lb. There is individual lubrication through each separate crank throw, to each individual crankpin bearing, force-feed lubrication being used, with a pressure of from 50 to 60 lb.

No flywheel is used other than the light steel gear arranged at the rear end for the electric starting motor mechanism. This starter works in the usual manner, by the pressing of a foot-button.

2180 R.P.M. Operating Speed

While the engine is designed to operate at 2180 r.p.m., the propeller is geared down by a front-end spur gear mechanism to give a propeller rotation of from 1000 to 1400 per minute. This means not only that weight is saved per horsepower by keeping the revolution up to the most efficient speed for power and economy, but that there is also a large saving in the efficiency of the propeller at the slower speed allowed.

The overhead valves are set at an angle and driven by overhead-camshafts, located between the rows of valves over



Packard twelve-cylinder aircraft engine undergoing dynamometer tests at the factory

each cylinder block. The camshafts are driven by a train of spur gears at the rear end of the engine, these all running on annular ball bearings. The camshafts operate in tubular oil-tight chambers, located over the cylinders. These chambers contain the *inner* ends of the valve rocker arms, while the *outer* ends, offset from the inner through an oil-tight bearing, project outside of the case to operate the valves. This construction not only allows for perfect lubrication of the camshaft and followers, but leaves the valves and valve-springs outside of the inclosed portion so that the springs may be properly cooled and thus not lose their temper. By removing a few bolts, the entire camshaft and rocker arm assembly can be removed from the top of the cylinder head, and it is a comparatively simple matter to remove the whole cylinder block.

With modern gasoline, the design of intake and exhaust manifolds is of a great deal more importance than ever before, and is in a large percentage of cases the cause for power limitations in modern gasoline engines. The engineering department has spent possibly more engineering thought and experiment on manifolding and carburetion than on any other one item.

The practical details of construction have been given unusual attention. For instance, there are only three sizes of bolts and nuts used in the whole construction, so that one special wrench will fit all bolts, thus eliminating the weight of a complicated tool kit. Joining surfaces are lapped, no gaskets being used in the entire engine, which also allows the greatest simplicity of assembly. Arrangements are made, as have been noted, for self-starting, for the fitting of a tachometer, and an air pump for pressure feed is standard on all installations.

The overhead-valve mechanism is so arranged that by slight change the exhaust can be arranged for either outside connections with the carbureter in the V, or better, the exhaust can leave the cylinders in the V and the intake manifolds and separate carbureters be arranged outside of each block.

Packard aeroplane engine propeller can drive truck

One of the tests to which the engine has been put and which illustrates the pulling power may be mentioned. The engine was mounted on the deck of a 5-ton Packard truck chassis and with the aeroplane propeller drove the chassis at high speed. The rear wheels of the truck were then locked and the truck driven over ground which was covered with snow.

World's Markets Ours If Properly Developed

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in import duties are granted on automobiles from Great Britain and that the Canadian market is supplied to a considerable extent by the branches of American factories, the importance of the British colonial market to the American automobile becomes quite apparent. There are several reasons to account for the success of the American cars in the British colonial markets. Social and economic conditions are more like those in the United States than in Europe.

3—The neutral countries will probably offer the best market after the war. Many of the neutral countries of Europe, particularly the Scandinavian countries, have been considerably strengthened by the war. There should be there a considerable demand for pleasure vehicles and American machines would in all probability prove well adapted to meet the demand.

There is one suggestion which I would like to make to those automobile manufacturers who are going into the foreign trade seriously and that is, that they might co-operate in the establishment of foreign depots of supplies and accessories. This would solve, to a considerable extent, the problem of service which is so important in the sale of automobiles. There is no competition to be met in the sale of parts. There does not seem to be any reason why the sale of such parts and accessories could not be arranged on a co-operative basis. Co-operation would also bring about some economies in the cost of transportation. The so-called Webb Bill now before Congress, which will probably be passed in some form or other, will undoubtedly permit the manufacturers to make some such effective arrangement, and I hope that the manufacturers will press their cases before Congress.

I may say in general that I believe that the effects of the European war will show themselves in increased costs in Europe and in a higher level of prices. I base this on the assumption that the cost of labor, the cost of capital, and the cost of government as seen in taxes, will each increase following the conclusion of the war, and that an increase in each of these items of cost inevitably means a higher price level. Undoubtedly in certain lines European factory production will have remained at a high standard of efficiency. There is no doubt but that the chemical industry and the iron and steel industry will be well organized and in fair going shape at the end of the war. The same thing is likely to be true of the automobile industry which has probably been producing at high capacity in order to supply the belligerent activities of the European nations.

One of the most important possible results of the war may be enactment of high tariffs in the various European countries. If this is done in Europe it will probably have an effect upon all of the colonial governments. If such tariffs are enacted manufacturers will have to consider the possibility of establishing branch factories or assembling plants in foreign countries in order to hold those markets.

Finally and in conclusion, the market for American automobiles is almost unlimited, especially in the low-priced and medium-priced cars. The extent of the market, or rather the extent to which we take advantage of the markets, depends in fact, it seem to me, only upon the soundness of our export methods, the character of the service which we are prepared to render, and the ability of our marketing organizations.

South Africa Needs U.S.A. Cars

Rough Roads and Climate Conditions Widen Opportunity

By William Campbell

William Campbell, the author, in the first Maxwell car in South Africa, near Johannesburg

EDITOR'S NOTE — William Campbell of Johannesburg, British South Africa, is one of the large automobile distributors and accessory men in that country. Mr. Campbell has just returned to British South Africa after spending several months in U. S. A. and Canada visiting automobile factories and negotiating for new lines of U. S. A. automobile goods to sell in B. S. A. He is a Scotchman by birth and possesses that keen business judgment peculiar to his race. He is agent for the Maxwell line in Johannesburg and carries many U. S. A. accessories. Mr. Campbell has had experience in newspaper work under Lord Northcliffe.

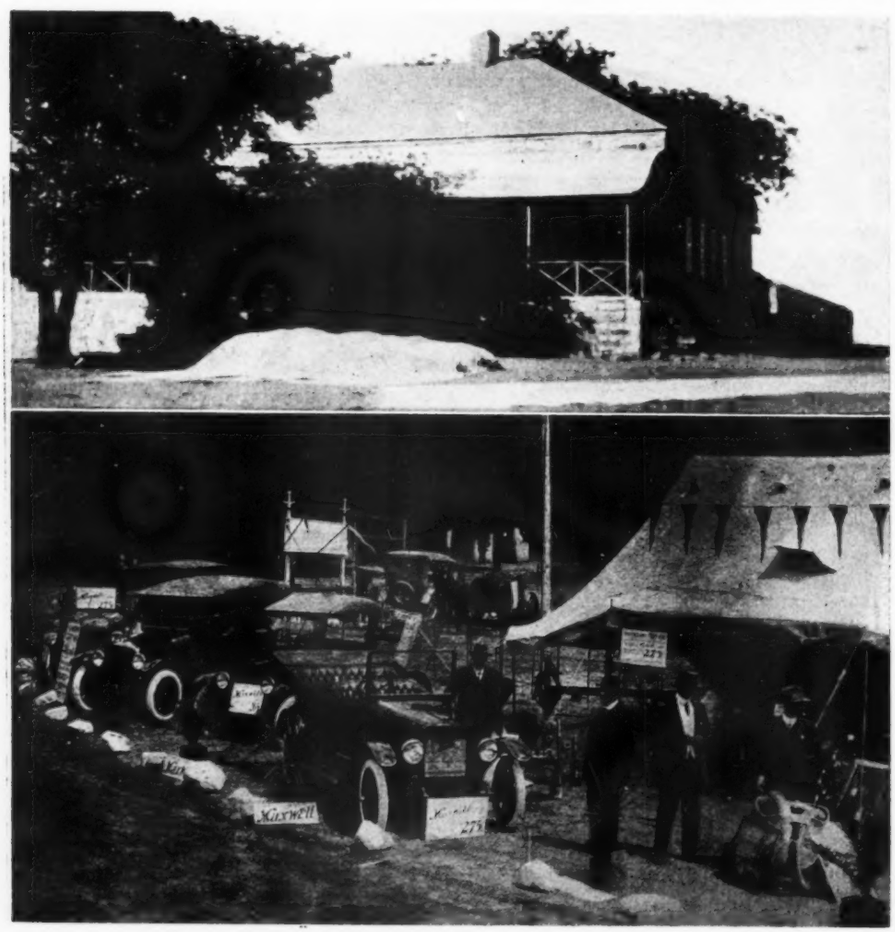
JOHANNESBURG, BRITISH SOUTH AFRICA—In the many surprises of the present war none was so complete and not-to-be-expected as that of South Africa—only a few years ago the foe of Britain and still hardly recovered from the scars of that devastating campaign—spontaneously springing to arms for the help of her recent conqueror. Not only is it a magnificent tribute to the wisdom of that splendid and audacious experiment in politics which gave her self-government but equally so is it a standard by which we can estimate the mind and quality of such men as General Botha and General Smuts. When peace will give us leisure to estimate aright, when we can place in right perspective all that was hazarded in their decision to practically unaided attempt the conquest of first, German Southwest and then German East Africa, we venture to predict that the verdict will indeed award them a high niche in the temple of fame.

How Cars Won a Campaign

But for the adoption of the automobile in modern warfare, brilliant as was the mind which conceived and so quickly brought to an issue, that first campaign—in German Southwest Africa—it could not possibly have been accomplished either so quickly or with so small a sacrifice of human lives. To enable the reader to understand it let us briefly outline the conditions. On its hundreds of miles of seacoast this German colony had its principal towns and rich agricultural country protected by an arid stretch of sand desert some 50 to 60 miles in depth presenting peculiar difficulties to infantry and cavalry, due to the absence of water and fodder. On the landward side, where the German territory abutted on Cape Colony, nature had provided an equally forbidding and barren stretch and something of the difficulties to be surmounted may be gathered from the fact that a large column of motor vehicles had to be mobilized for water transport alone and it is estimated that every gallon of water so delivered to man or animal cost the Government $2.50. Doubtless this gave a sense of security to the Germans and, in fact, proved their undoing. From the sea the Germans anticipated and

Map of South Africa showing the territory over large part of which Mr. Campbell extends his dealings in automobiles and accessories

Looking over the great gold mines in the vicinity of Johannesburg from a point of vantage in the city. The great bulk of the gold production of South Africa, the value of the annual exports of which amounts to $170,000,000, is obtained within a radius of 60 miles of the city. Only a small portion of the city is visible in the illustration.



Above—T'seodien—Livingston Mission Station—The home of the author. This is situated on the border land of German Southwest Africa
Below—Rosebank show of automobiles held in British South Africa

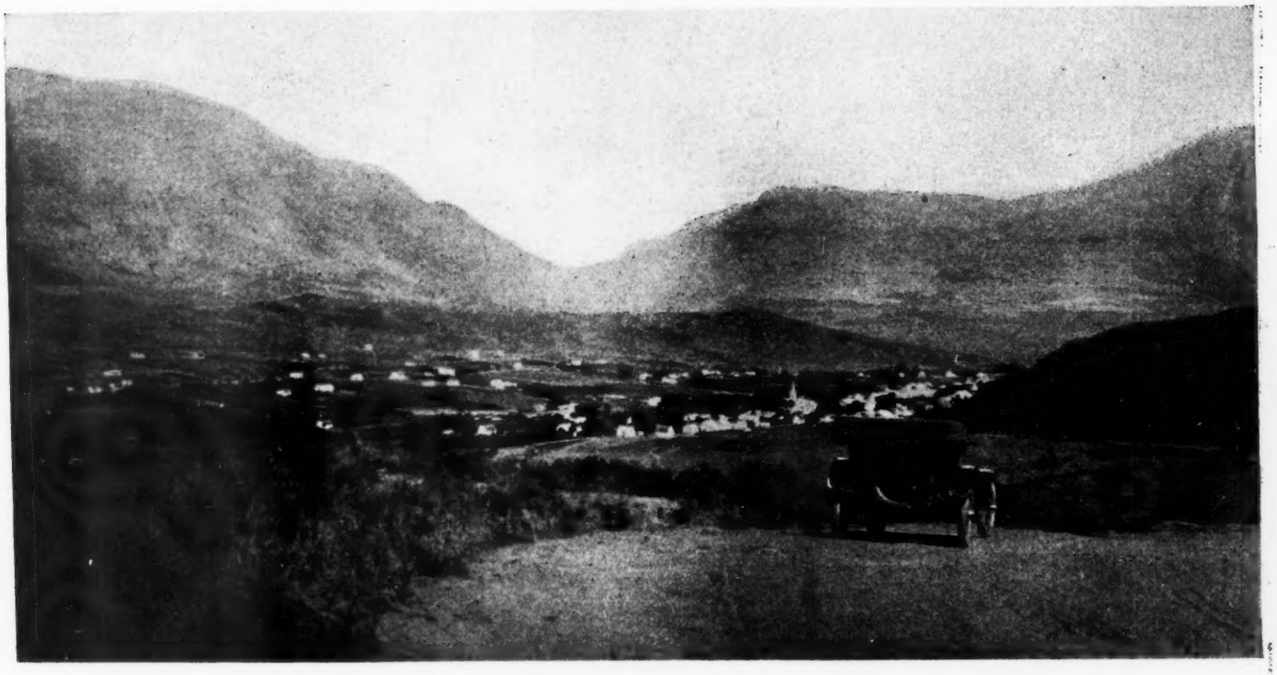
prepared for attack but so confident were they that the hinterland was impassable to automobile or horse that after one of the first small engagements a captured German officer declared his belief that only by laying a lumber track all the way was it possible for the automobile to have passed through. No such experiment was adopted but instead the dry bed of what was once the broad and mighty Kuruman river—a stream which now disappears into the earth 7 miles from its source—was utilized. By it, excellently provisioned with food and water, entered the British general and his mobile force and so surprised were the enemy that, forsaking their entrenchments and forts, they fled north, and, with their main forces, were ultimately surrounded.

U. S. A. Cars Used

In this war, as in the rebellion and the present campaign in East Africa, U. S. A. automobiles, because of their power and lightness combined with ability to negotiate sand, played an important part, Maxwells, Reos, Hupmobiles and Fords chiefly figuring.

Distances Are Vast

To understand South Africa, its present and the great possibilities of its future, you must visualize its vast distances, 3000 miles from the Cape to Northern Rhodesia, 1500



A view of Barrydale, Cape Colony. This may be considered as a typical South African small town

miles from sea to sea, its sparse population capable of the purchase of luxuries, there being only 1,125,000 white people in this enormous area, its mineral wealth with an annual export of gold to the amount of $170,000,000, of diamonds to another $70,000,000, and smaller amounts in the baser metals, its already large and important exports in wool, skins, ostrich feathers and fruits.

Preparation for Future

Then add to this its more than remarkable advances in agriculture with a climate capable of growing from wheat to cotton and rapidly becoming a dairy and cattle rearing country and this fostered by a government which not only recognizes the value both of the farmer and the miner in its development but is prepared to spend money with a view to the future.

Roads Problem Is Huge

Its government railway development has been rapid, but like the U. S. A. the problem of good roads is one whose very vastness is apt to overwhelm. In fact, outside the towns and suburban areas there are no roads, only rough tracks unmarked and practically neglected. Hence has come the opportunity of the American automobile, with its light weight, flexibility, high clearance and moderate price. That opportunity has been greatly increased by war conditions and that, too, in spite of the high price of

Above—On the 6-mile climb up the Katsberg at a spot over 3000 ft. up. This climb is encountered on the road from East London to Orange Free State, the grade averaging about 8 per cent and the road surface not particularly smooth

Below—In the South African sand. Stretches of 5 miles of such sand are frequently encountered in traveling through this territory

Above at left—A view of Montagu Pass in Cape Colony, British South Africa. At the right is another view in this pass, showing the climb on the road from the coast to Odtshoorn, a great center for the production of ostrich feathers. There are excellent roads in this locality in spite of the fact that there is an area of 100 square miles of sand

Lower—This illustration shows how U. S. A. automobiles transported the British South African troops across a desert stretch in German Southwest Africa by traveling the dried-up bed of the Kuruman River, here almost 2 miles across

Mulder's Drift hillclimb, a well-known ascent near the city of Johannesburg

gasoline—84 cents per imperial gallon—and the additional handicap that owing to high freight and duty an automobile has to be sold at considerably more than double what the U. S. A. owner pays for his car.

More also is expected by the owner from his car: It must as a daily experience negotiate with ease gradients that are not often met with in U. S. A. and that, too, with a loose, stony surface. It must ford rivers and be absolutely dependable in this work, as one cannot risk having to foot it for assistance when the nearest homestead or town may be 5 or 10 miles distant. As for sand and rough veldt, or prairie, or a steady climb of 2000 to 3000 ft., that is expected of any automobile as a matter of course. It therefore says much for automobile engineering that not only has the engineer fully met the complex problem but that the demand continues to grow in spite of

the neglect and misuse too often given the car by its owner.

Modern and progressive are terms that can with truth be applied to the South African dealer. To the pioneers of the industry it was at first often a heart-breaking experience, a great risk in capital and effort often seemingly without result. Their problems were frequently peculiar to the territory and local conditions and their limited market in the early days made the manufacturer consistently indifferent to their suggestions. What they considered and knew to be necessary for their market the maker looked on as a fad or non-essential. That they held on and triumphed is a tribute to their quality and who shall deny them their success. To-day they are the compeers of their brethren in more favored countries, pushing and capable with up-to-date garages, competent workmen, modern equipment and giving service to their patrons second to none.

The automobile market is increasingly a difficult one to break into with a new make of car and some even of established names have prejudiced their product by frequent change in chassis or model, for it has to be remembered that dealers are over 6000 miles from their source of supply and cannot afford to take the risk of ventures that have not behind them the elements of permanency, or take the trouble and risk of carrying stock of parts to meet the demand of numerous and varied models.

After the War

After the war, what?

British makes are bound to become a serious factor but, so far, no English manufacturer is planning to produce a really cheap car. Above what you know as the $1,000 car, the future, so far as the British Colonies are concerned, is with the English manufacturer. He will re-enter the field with some great advantage. The war has accustomed him to quantity production, his factories and equipment have been tremendously enlarged and at practically no cost to himself and he will have in his favor an intensified sentiment for "British Made." His product will have a new value, and sentiment counts more than we care to admit. It will retain the custom-made element. It will continue to possess the individual look, that indefinable something which picks it out from the article of quantity production. The British maker has learned new wrinkles from his war experience, he has accumulated capital and his markets wait for him.

Of the country itself, what shall we say?

With a climate varied enough—from temperate to sub-tropical—to permit the cultivation of all classes of produce, yet with a climate taken all over which cannot be matched by any equal territory in the world, it is ideal for automobile touring; and the trav-

Above—A typical river crossing. All through British South Africa streams of this type are encountered which must be forded in one way or another

Right — A view in French Hook Valley, Cape Colony, British South Africa. This is a great center for tobacco and grape raising. The author of the article, William Campbell, is seated in the tonneau of the car

Above—The author's Maxwell car at Montagu Pass in Cape Colony, British South Africa
Below—One of the roads in Sanspruit. There are many roads in British South Africa that are mere trails. All through this territory bridges are very few and fording streams is a recognized part of the incidentals of automobiling

eler, no matter what his taste may be, can have it satisfied.

Starting from Cape Town, the natural port of the sub-continent ideally placed under the shelter of the famous Table mountain, he can there begin an historical survey of the country at the scene of the landing of its early Dutch discoverers, trace the progress of civilization and with it agricultural wealth, having as its milestones the beautiful old and comfortable Dutch farmhouses. He can discover how deep a mark the Huguenots, fleeing from religious persecution, have left upon the colonies. He can follow the footsteps either of the early Dutch pioneers as they resolutely pushed inland or the advance along the east coast of the early British settlers marked by an equally distinct type of architecture. He can mark the influence and acceleration of development that followed the discovery of mineral wealth in the form of gold and diamonds. He can close his tour with a visit to South Africa's historic battlefields, concluding his holiday amid the sub-tropical scenery of our Garden Colony, reaching the shores of the Indian Ocean at Durban our great seaside resort and large import center.

Such a tour may extend from 2000 to 3000 miles and can be done by short stages, the traveler being sure that each evening he can find comfortable and modern hotel accommodation even in the smaller towns and at a cost so moderate as to surprise.

Along the Coast

Along the coast line he will find a belt of comparatively low-lying land, agriculturally rich and highly cultivated much of it with a rare beauty having in it the element of surprise and frequent change. Here he will find an agriculture which ranges from corn to tobacco, from grapes to bananas, which includes not only cattle-raising and dairying but also covers the growth of wool and ostrich feathers. In rising to the high table lands of the Karoo, Free State and Transvaal he will meet steady climbs of 3000 ft. and more which will severely test the qualities of his automobile. He need not hesitate for in that the American car especially scores and he can gather confidence from the fact that many of the illustrations which accompany this article were taken by the writer on a like tour of 1826 miles. The only discomforts were a few cases of tire trouble.

In the Mountains

Once the tourist has surmounted these mountain passes his task is an easy one. He may indeed find difficulty in deciding which road or track to take but a little inquiry will keep him right. The scenery has entirely changed and can be best described in the words of an American visitor as "a mighty fine clearing" but the absence of trees and the monotony of the flat will be more than compensated by the exhilaration of the mountain air and the peculiar charm of the veldt at sunrise and sundown.

The visitor will do well to visit Bloemfontein and then cross to Kimberly and examine the wonderful diamond mines before proceeding to Johannesburg, the center of the largest gold-producing area in the world. The industry, the growth of a matter of 30 years, will surprise him but equally so will the town itself—modern, prosperous and growing with much of the hustle and bustle which is usually considered characteristic of American city life.

480 Miles Over Rolling Country

A day's visit can be given to Pretoria, the seat of the government administration as Cape Town is the parliamentary center. The visit can be concluded by a tour of 480 miles, descending again to the coast, passing through a new and more luxuriant type of vegetation, and more undulating country and again reaching sea coast at Durban where east and west meet both in the civilization and the products of the country.

Worm-Gear Theory and Practice

Part I

THIS is the first of a series of articles extracted from the paper recently delivered by F. W. Lanchester before the British Institution of Automobile Engineers. This paper is of such length that it practically amounts to a text book on the subject. While it deals particularly with the advantages of the Lanchester or Hindley type of gearing, the portions devoted to worm and wheel mounting are applicable to the parallel type of worm gear also. It will probably rank as a standard work of reference for years to come.

LANCHESTER'S original paper is divided into several parts. The introduction refers to tests which were made by the British National Physical Laboratory (the equivalent of the Bureau of Standards) of a Lanchester gear and of a parallel gear which was not named. The author explains that in accordance with the wishes of David Brown & Sons, who made the parallel gear, their name is now disclosed, and he proceeds to describe comparative tests made by him of Lanchester worms and David Brown worms in competition.

Part one of the paper considers these tests in detail, describes how sections of parallel and Hindley worms in mesh with corresponding wheels were prepared and may be summed up as the statement of a complete case in favor of the Lanchester type. Following this, the author goes on to describe various methods of mounting and this is really the most valuable part of the paper. It contains instructions for both the engineer and the factory and shows what tolerances are important and what are not.

Unfortunately, the photographs of the sections of the worms and worm wheels referred to in the paper have only reached this country in the form of reproductions and these reproductions are so faint that their detail cannot be seen. For this reason in the reprint it has been possible to use only three, and the diagrams developed from the photographs.

From the paper itself some paragraphs have been removed for the sake of condensation. In no case do these contain any information of a very important character.

Many Variables in Design

There are a great number of variables—an inconveniently great number of variables—in the design of worm gear upon which its efficiency depends. Without digesting the problem the factors are very numerous; there are thus the diameters of the worm and the wheel and the gear ratio, also the velocity of rotation, and the torque or the horsepower transmitted. Beyond this there is the degree of proximate contact between the pressure surfaces, and there is the question of lubrication.

The author's theoretical treatment is based definitely on the fact that the first group of variable factors, namely, the diameters of worm and wheel, the gear ratio, the revolution speed and torque transmitted, can all be represented from the point of view of efficiency in the one quantity, the pitch angle of the tooth and an assumed constant *angle or coefficient of friction.* For any set of gear between wide limits of load and speed the angle of friction is in fact almost constant, quite near enough so for the purposes of the foundation theory. On this assumption (*i.e.*, angle of friction = constant), it is then easy to demonstrate that the efficiency will be constant for all variations of torque and speed, also that the efficiency is independent of the diameters of the gears provided that the pitch angle of the teeth is the same. The approximate truth of this is an experimentally established fact is the justification of the method, and this has been fully established by the official tests.

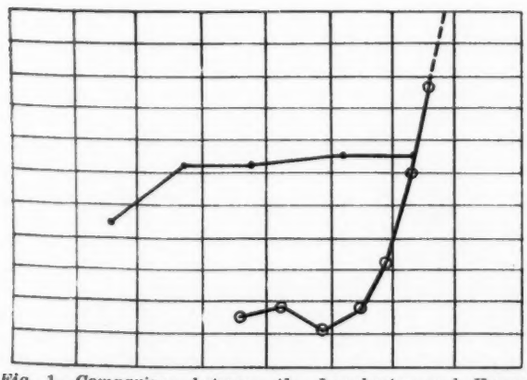


Fig. 1—Comparison between the Lanchester and Kennerson tests. The left curve called B in the text is a typical Lanchester, there being little variation in efficiency from 27 up to 62 hp. The other curve, called A in the text, is from Kennerson's work and shows a much larger variation over much the same range.

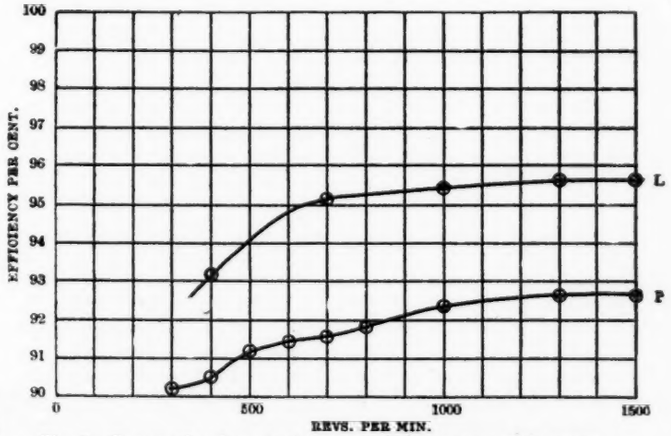
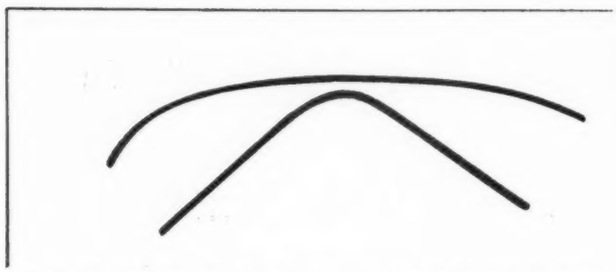


Fig. 2—Curves showing constancy of efficiency over wide range. L is a Lanchester gear and P a straight gear, both tests being made on the Lanchester machine.



Figs. 3a and 3b—The flatter curve is called 3a and is more typical of the form of a worm gear efficiency curve than is the sharper peaked curve 3b

In Fig. 1 a comparison is given between one of the tests and one of the so-called tests of a parallel worm cited by Mr. Kerr-Thomas, namely, from a paper by Professor Kennerson. Here, B, we see the test of a Daimler-Lanchester worm in which from about 27 hp. to 62 hp. the efficiency does not vary more than one-third of 1 per cent, whereas in the plottings from Professor Kennerson's paper, A, there is a curve which ranges from 35 to 65 hp. over a variation of 8 per cent. Now in the results taken with the author's dynamometer, which is certified to be true within one-fifth of 1 per cent and is probably ordinarily within 1 in 1000, a considerable range of load was found in every case, over which the efficiency was virtually constant, both in the Lanchester and parallel types, and similarly the efficiency was also virtually constant over a considerable range of speed, though here the variations were, perhaps, somewhat greater.

The author's own tests (on his dynamometer) of worm gear of the parallel type show clearly the same characteristic feature, namely, the approximate constancy of the efficiency over a considerable range of velocity. Two typical curves are given in Fig. 2.

Critical Tooth Load

There are two conditions under which it would appear that the efficiency *invariably* shows a falling off; firstly, when the load per tooth for any given pair of gears exceeds a certain value, the other is when the tooth rubbing velocity is less than a certain value; also there is, without question, a falling off in the opposite extremes if a sufficiently great range of speed or load be investigated. Otherwise the approximate constancy of the angle or coefficient of friction may be taken as established. It is evident that the constant condition corresponds to the minimum value of coefficient, or conversely the maximum of efficiency. In the nature of things, where A is a function of B, A is approximately constant in respect of B when A is a maximum and when A is a minimum. This is as commonly expressed in the equation for maximum or minimum value as $dA/dB = 0$. Thus there is nothing extraordinary in the fact as stated. Its importance from the point of view of the theory of worm gear efficiency lies in the fact that the maximum is rarely, if ever, found to be a "peak," it is rather a "table land," it is of the type shown in Fig. 3a, rather than the type shown in Fig. 3b. It is a further point of importance in connection with the theory of worm gear that the practical range of usage over which efficiency is important does not carry us into the regions where the higher coefficients are met with. Indeed, it is actually the increase of the coefficient and falling off in the efficiency under excessive load that determines sharply the maximum load limit to which any given pair of gears may be subjected, for a very moderate increase in coefficient above its normal "least value" results in, or is evidence of, the partial breakdown or rupture of the lubrication film and the disintegration of the gear.

This is the case whether it be of the Lanchester or parallel type; in fact the increase of the coefficient under heavy loading is the first sign of incipient lubrication failure, and so the point of fall in the efficiency curve under heavy loading may be taken as an invariable indication, in the comparison of any two pairs of gear, of their relative higher load limits.

In engineering practice we are accustomed to meet problems in which the coefficient of friction is legitimately treated as constant; in all these problems certain actual variations exist, but the underlying fact is so nearly true that the basis theory is correctly founded on the assumption of a constant coefficient of friction, and such changes as are met with are considered as variations from this constant value rather than in relation to the zero.

So far we have dealt with the group of factors which determine the efficiency as based on the coefficient of friction; in other words, we have confined our attention to the group of variable quantities which suffice to determine the efficiency *once the angle of friction is stated*, and have seen that these are summed up in the one quantity, the *pitch angle*. It is clear that the assumption of a constant angle of friction simplifies matters to the utmost possible extent, for in place of the multitude of different variables we have only to consider the pitch angle of the tooth, that is, the angle relatively to the worm axis—all the quantities on which this angle depends are then accounted for.

The other half of the problem is to deal with the factors on which the constant or minimum coefficient of friction for any given pair of gears depends, and more broadly the factors on which the extent of the approximately constant range depends, for it is the extent of this range in the direction of high loading which determines the maximum output capacity at any given speed of a pair of gears, and so determines their commercial value as an engineering asset.

The commercial value of high power-transmission capacity from an automobile standpoint may be regarded as even greater than from an engineering standpoint, for the importance of weight saving is paramount. Thus, if two sets of gears, one of 8 in. and another of 10 in. centers, were to possess the same horsepower capacity of a given revolution speed, and even (owing to a difference of design or material) were to cost the same, one might be justified in considering them equally favorably in any ordinary engineering problem, but if the 8 in. center gears weigh proportionately less than the 10 in. center set, they will be far more valuable, and a more saleable article, from the point of view of the automobile constructor and user.

Two Types of Efficiency Curve

The efficiency curve in any case is of the type represented in Fig. 3a. At very light loads the efficiency may be poor owing to the fact that oil is being churned in the gear and churned in the bearings, since the power so consumed is virtually independent of the load. On the other hand (as already pointed out) the efficiency curve falls at heavy load owing to the thinning and incipient breakdown of the lubricating film.

It has been regarded as open to question to what extent the magnitude of minimum coefficient (maximum efficiency) is controllable; the author has found evidence of considerable variation according to the type of gear and lubricant. If it were not controllable, then the maximum efficiency for every individual pair of gears under the most favorable conditions would depend definitely upon the pitch angle of the tooth, and would be the same whether the gear is of the parallel or Lanchester type.

It has also been regarded as an open question whether the *breadth* of the "table land," if one may say so, of the efficiency curve can be increased. Thus it might be argued that if, by obtaining better proximate contact (by any means) the breaking down of the lubrication could be persuaded to take place at a *higher* tooth load, this same greater proximity of the tooth surfaces may result in a higher viscous churning

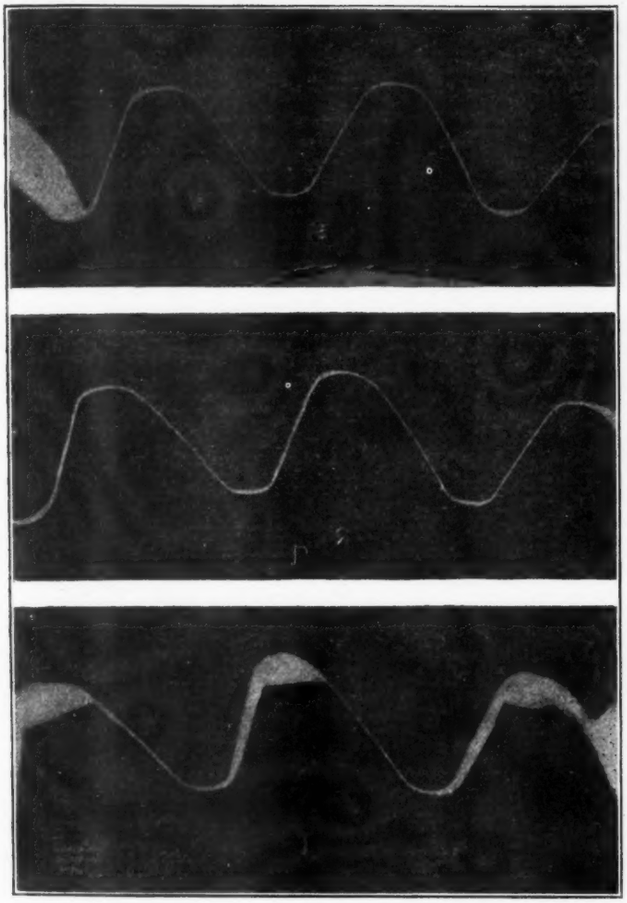


Fig. 4—Sections of Lanchester gear

resistance and so take off in the range of coefficient at one end what it puts on at the other.

Although the author is prepared to take a liberal view and say that these points are open to controversy, his opinion, as based on present-day experience, is decidedly that a better type of tooth contact corresponds to an absolute lower minimum coefficient—probably due to a *thickening* of the oil film over the load-bearing area, and that this does not of necessity add to the churning loss, and thus the improvement results in an *absolute* broadening of the top of the efficiency curve, that is to say, an increase both in the *maximum* efficiency and in the *range* over which there is no sensible falling off.

But the benefit of obtaining high tooth loads by improving the proximate contact of the teeth does not depend intrinsically on an actual increase in the range. Even if what be gained at one end be lost at the other, the result of improving the proximate contact of the teeth is to enable a given pair of gears to transmit a higher standard of loading. Conversely, for a given horsepower transmission a smaller and lighter set of gears may be employed, with a saving of money in material and machining, and a saving of weight in the gears themselves and in the mounting.

We therefore realise that the essence of power transmission worm gear for automobile purposes is to be sought in achieving the highest tooth load compatible with the maintenance of the oil film and the approximate minimum coefficient of friction; any and every improvement in the area of proximate contact of the tooth surface in engagement with one another will be reflected in a bigger output from a given pair of gears and a reduction in the size and weight of gears for a given performance. It is one of the main objects of the present paper to examine the differences and relative merits of the Lanchester and parallel types of worm gear in this respect.

The advantage of reducing the centers and diminishing the size of a pair of gears for any given automobile is not only a matter of weight saving, important though this may be: it is equally a matter of compactness of design. It is and has been one of the difficulties in the application of worm gear to the back axle that if the worm be arranged beneath the wheel the ground clearance is jeopardised, and if it be arranged above the wheel the body clearance has to be cut fine. The result of experience appears to show that for the English market the question of ground clearance is the less important; a full

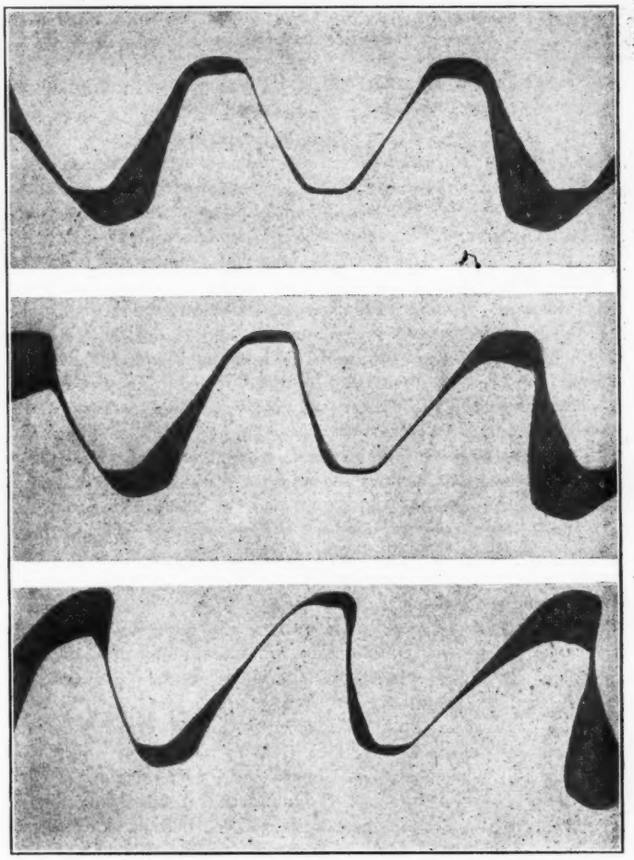


Fig. 5—Sections of straight worm gear

size touring car with 35-in. driving wheels and a worm gear of 6-in. centers can be designed to give an 8-in. clearance in the center of the rear axle, and this has proved itself ample for use in the British Isles, where consequently the underneath worm is widely used. It must be remembered that a clearance of 8-in. on the rear axle is as good as a clearance of perhaps, 12-in. or more under the body of the car, since the body clearance has to allow for longitudinal undulations of the road as well as lateral, with an additional allowance for spring deflection.

It has been reported from colonial sources that the worm undernearth is objectionable as not providing sufficient clearance. The author is doubtful whether this objection is generally valid; the same objections once carried weight in commercial circles with regard to the home market. It seems incredible, with the wheel base now accepted, some 132 or 144-in., or more, that, if a clearance of 12 in. is required under the axle, anything less than 18-in. or 20-in. can be sufficient under the body of the car. Apart from the mere question of actual clearance, a contact between the road or chance boulders and the flywheel or base of the engine is

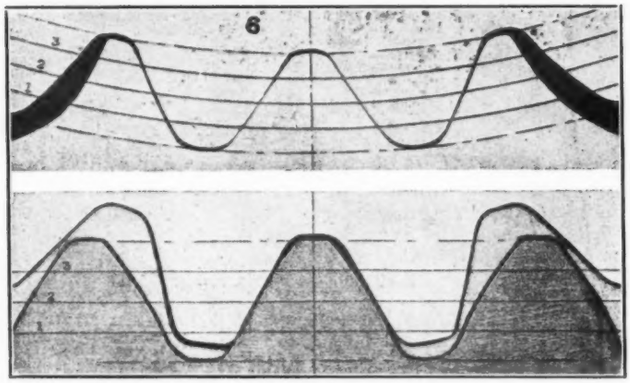


Fig. 6—Sections of Lanchester and straight gears in mesh, the Lanchester gear being the upper of the two

liable to prove far more serious than the contact of the comparatively robust housing of the worm gear. However this may be, the objection exists, and has been sufficiently strong to induce many of our constructors when adopting worm gear to place the worm above instead of below.

When the worm is placed above the axle the question of body clearance gives trouble. Now the fashion, at least for the home market, is to keep down the floor level as low as possible—a "pleasure" car with a high floor level and center of gravity is to-day unsalable, in the author's opinion rightly so. The result of this is that where cars have the worm placed above the axle it is often found necessary to gouge a piece out of the rear body, and fit a casing which protrudes through the rear body floor in order to provide the necessary clearance.

Beyond the above, the cooling of the worm box with the worm on top is inferior to what it is when the worm is placed underneath; the actual importance of this point depends upon the general design of the car.

There is thus every inducement, apart from the already important consideration of weight, to endeavor by all possible means to obtain the maximum horsepower or torque transmission capacity from a gear of any given size.

It has been shown that in worm gears of different types the efficiency depends upon two factors, the pitch angle of the teeth and a constant—the coefficient of friction. In the work done with the author's dynamometer, it has been made abundantly evident that the constant, the coefficient of friction, has a different value in different cases; it is liable to slight variation in almost every different pair of gears tested, but the variation only becomes marked when the type of gear as determined by the system of cutting differs. The author's suggestion has been that the value of the coefficient is affected by the *degree of proximate contact of the teeth* and the consequent variation in the thickness of the oil film. Over the region by which the tooth load is borne—the thicker the oil film the lower will be the coefficient of friction.

It would be possible in the case of the parallel gear to determine as a matter of pure geometry the extent of the clearances and the radii of curvature of the surfaces in contact at different points on the worm and wheel teeth where in engagement, and in fact in some degree this has already been done. It is conceivably possible that the same method might be used in the case of the Lanchester gear, but it would be extremely tedious and difficult, and at the best somewhat uncertain. For the purpose of the present paper it has been thought preferable to arrive at the result in both cases by actually dissecting a set of gears soldered together and reproducing the teeth form to an enlarged scale by photographic means. From the photographs so obtained it has been found possible to prepare drawings showing the curvature at the engagement surfaces along the path of motion, that is to say, more or less nearly normal to the plane of the photographic section.

In order to avoid unnecessary sectioning both faces of each slice were photographed as representing sections, and the thickness of the slice (one-eighth inch) was made the same as the thickness of the saw used in the cutting operation. In order that the photographs should read correctly, that is to say, so that they should be readily intelligible, the alternate number were reversed photographically, so that instead of the views being from alternately in front and behind the gear wheel as is actually the case in examining the sections themselves, the photographs given in the plates illustrating the paper represent a series of sections one behind the other, all viewed in one direction.

Figs. 4 and 5 give sample photographs of sections, Lanchester and D. B. S. respectively, to an enlarged scale.

The point of view of the photographs, however, does not give as clear an impression of the form or of the contiguity of the contact surfaces as might be wished; in order more fully to realize the type of the contact as defined by the difference in the radius of curvature of the two surfaces in their direction of relative motion, a *development* is required, in the case of the Lanchester the surface being one of double curvature. Any such development is of necessity a matter

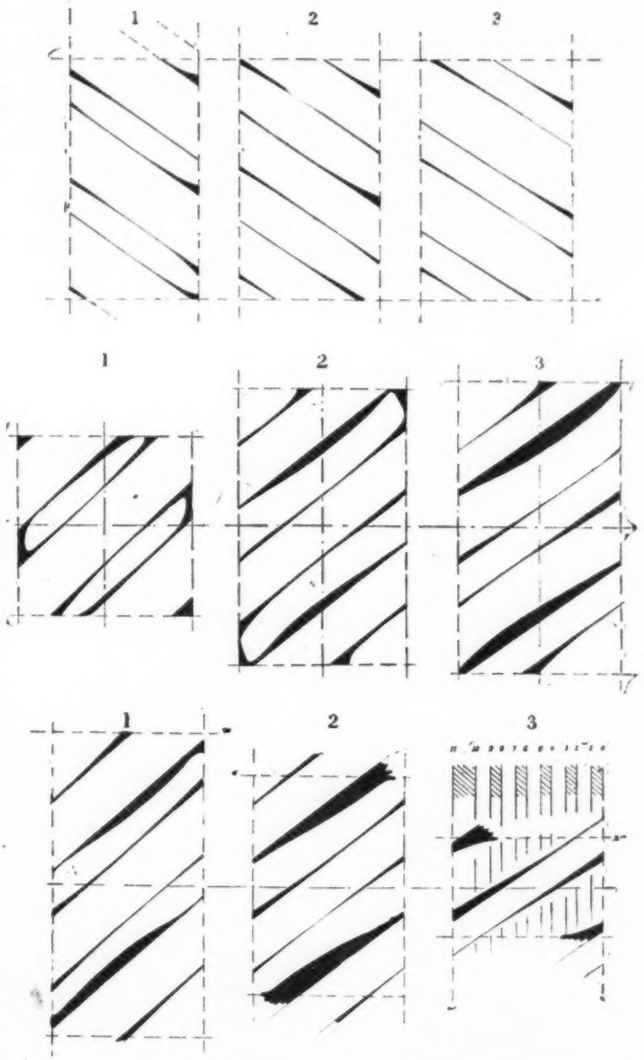


Fig. 7—Developments showing areas of contact discovered by cutting up into sections various worm gears. The top one is called a in the text, center b and lowest c

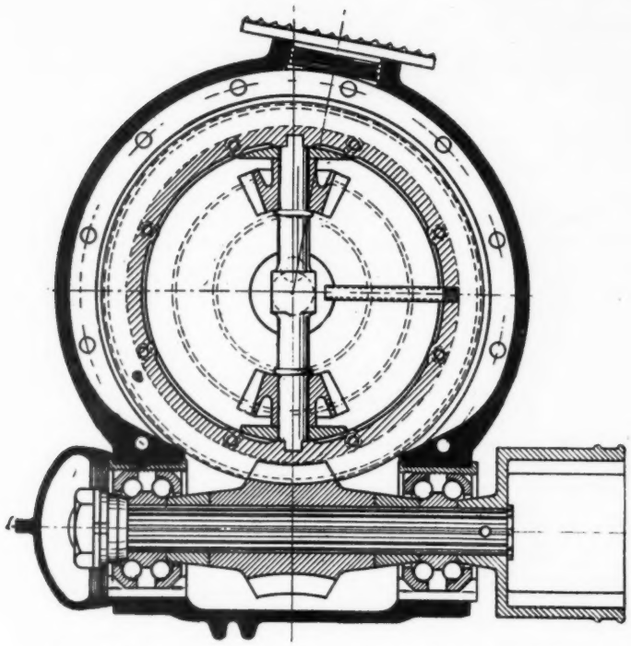


Fig. 8—Old fashioned worm gear with bicycle type bearings

of convention—a convention involving some degree of distortion.

In the present case the construction adopted has been to take a number of concentric sections, three in all, one on the center of the tooth height or pitch line, and one at one-quarter and one at three-quarters of the tooth height respectively; the reconstruction has been made in Fig. 7a, representing the Lanchester gear, and Fig. 7b, representing the parallel type. Since it is not the absolute curvature of the surfaces which is important but rather the *difference of curvature*, and in order to avoid complicated draughtsmanship, the worm tooth faces have, as a matter of construction, been represented by straight lines, and the whole of the curvature has been assigned to the worm wheel teeth. Thus the tooth sections shown in Figs. 7a and 7b represent correctly the interspace between the teeth in engagement at various points, and so define the degree of proximate contact between the teeth, but the curvature of the worm and wheel tooth faces respectively must not be taken as individually represented.

Referring to Fig. 6 in which are shown the middle sections respectively of the Lanchester and the D. B. S. gear, it will be noted that whereas the surfaces represented by their development in Figs. 7a and 7b are surfaces of double curvature in the Lanchester gear, they are ordinary cylindrical surfaces in the case of the parallel worm; clearly, it is necessary to adapt the geometry to the variation of type. Thus, whereas in the Lanchester, as before stated, the development, Fig. 7a must be regarded as to some extent a convention, in the case of the D. B. S. worm it is a true development of a right cylinder, and the assumption of the uniform and parallel worm teeth is strictly accurate. In the sections Fig. 6 the three surfaces of section at ¼, ½ and ¾ of the tooth height are numbered respectively 1, 2 and 3 in both cases, and corresponding figures of reference are given in Figs. 7a and 7b.

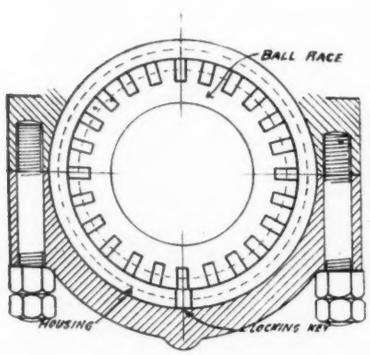
In order that it may be quite clear that the difference—the very striking difference—between the character of the clearances in the Lanchester gear 7a and the D. B. S. 7b are in nowise due to the difference in the manner of defining the surfaces of section, Fig. 7c has been prepared on the same basis as that of Fig. 7a. It is not only clear here that no exaggeration of clearances has resulted from the method of representation, but it is also clear that the surface of section must necessarily be chosen in harmony with the geometrical basis of design—thus, in Fig. 7c, the conventional worm teeth appear in places where they actually do not exist.

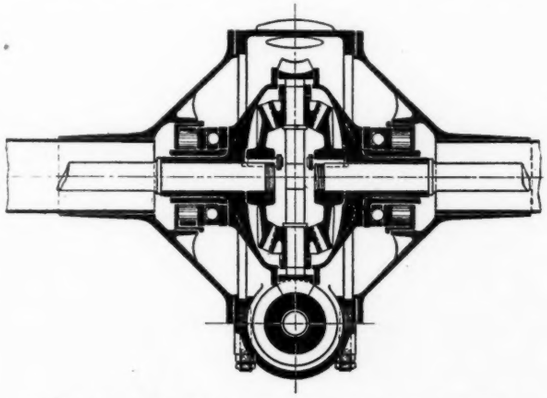
Now referring to Figs. 7, a, b, and c, it may be observed that we are not much nearer being able to define how much of the worm tooth *actually takes the pressure reaction*, but reading these figures in conjunction with the photographs (not published), we are in a position to state that for a given size of gear (centers), the effective area called upon to support the load will be greater in one case than in another. With so marked a difference in the curvature of the surfaces between the two types, if there were not some corresponding difference in the test result it would certainly be extraordinary.

Of the experimental fact that the Lanchester type of gear will carry more load, centers for centers, than any parallel type hitherto tested, I think there is no doubt whatever. In the results now published there is an adequate explanation of and reason for this experimental fact.

Method of Cutting Sections

In planning the cutting up of the worm block into sections, consideration was given to the fact that it is desirable to have one of the sections in the plane of the worm axis (as in sections Fig. 6); the plan adopted is shown diagrammatically in the right-hand section (3) of Fig. 7c. The alternative presented itself of either milling away the last section and having no terminal record of the tooth, or of leaving the last section double thickness—the latter was the course adopted. Thus, taking the original face preceding the first section as 0, the total width being 1½-in., the middle section falls to 6, and what would have been the eleventh section is missing, the terminal face being so numbered.





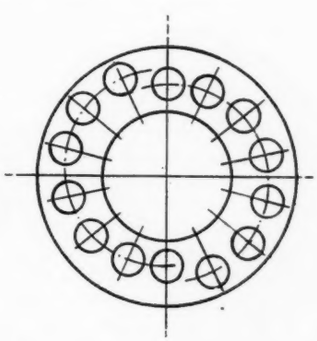


Fig. 9—Method for locking adjustment of bearings shown in Fig. 8; Fig. 10—Method of mounting worm wheel on roller bearings with ball thrusts, and Fig. 11—Staggered balls in old thrust race to prevent uneven wear

The conditions under which the rubbing surfaces of worm and wheel perform their duties are not sufficiently defined to enable an *a priori* estimate of the bearing capacity of the surfaces as based on their radius of curvature, or rather their difference of curvature. The curvature, however, must nevertheless remain some criterion and, as an approximation to the truth, it would be reasonable to assign the bearing or load capacity on the basis that a certain proximity of contact is effective in the transmission of pressure as due to the oil film. The area of the two surfaces capable of transmitting pressure may be taken as an area over which the tooth surfaces come within some definite small distance one from the other. As a working basis we might take one of the surfaces as a plane, and the area in question will then be proportional, for spherical contact, to the radius of curvature. Where the contact is ellipsoidal and we know the radius of curvature of the major and of the minor axes, the area of proximate contact may be taken as proportional to the product of the square roots of the two.

The application of this method of assessment is not so easy. For example, in the Lanchester gear in Fig. 7a, and also in the actual photographs, there are surfaces which are optically in contact, and it would take more refined methods than those so far employed to enable the curvature difference to be assessed. In the D. B. S. gear, on the other hand, the curvature difference, both in Fig. 7b and in the photograph, is very considerable, but the variations are very considerable from place to place.

Worm Gear Mounting

It has frequently been urged, to some extent truly, that the Hindley or Lanchester worm gear requires greater precautions in mounting than is the case with a gear of the parallel type. The point is that whereas in the Lanchester type the worm thrust has to be accurately located, in the parallel type so long as the worm axis is correct as to position, the longitudinal location of the worm is of no importance. The matter may be carried a step further; worm gear of the parallel type in turn may be said to require more careful mounting than common screw gear, in which both worm and wheel are of the ordinary screw-cut spiral form. Thus the argument that the Hindley or Lanchester gear is at a disadvantage, on account of the extra precautions required, as compared with parallel worm gear, may be quite as reasonably urged against worm gear of every kind in favor of ordinary screw gearing such as is commonly used to drive the side shaft of a gas engine. Such arguments are clearly without weight if any adequate advantage can be shown.

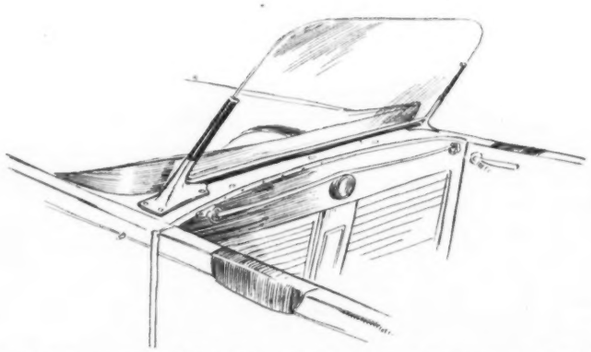
In practice the whole point of difference hinges on the correct location of the *worm* thrusts, since in every other respect any want or loss of alinement affects both types of gear equally. It may be doubted as a matter of experience whether the Hindley type of worm gear is actually at as great a disadvantage as its detractors would represent, the Lanchester gear at least has shown itself capable of working surprisingly well under the severe conditions which supervene when a worm thrust bearing fails. Admitting, however, that the durability of the gear does definitely depend upon the permanence of alinement as determined by the thrust bearing, the problem itself resolves itself into the comparatively simple question of how, under manufacturing conditions, the initial accuracy of alinement can be secured; beyond this, the durability of the alinement resolves itself into a question of fixing the proportion and type of thrust bearing best employed, and of the general soundness of the mounting as a piece of engineering.

The earliest type of mounting employed in the application of worm gear to the original Lanchester car is shown in Figs. 8 and 10. Here it will be noted that the ball bearings are not of the modern type, the design dating back to a time when such bearings were not a standardized or a marketed commodity; two double bearings of the bicycle cup and cone type are arranged at opposite ends of the worm, the whole combination being symmetrical. The cups were made adjustable by housing them within an internally screwed sleeve piece, and the adjustment was fixed by a key or cotter engaging with one of twenty-four notches cut in the periphery of each cup, Fig. 9. The pitch of the thread was twelve per inch, so that the design gave a capacity of adjustment to within approximately three and a half one-thousandths of an inch, which was found to give satisfactory results in practice. Here we stumble against one of the misconceptions which are current with regard to the Hindley type of gear; it has often been represented that the accuracy of alinement of the worm required to be true to within a thousandth of an inch of geometrical accuracy; from the success of the arrangement described, it is clear that no such degree of accuracy is essential.

It will be noted in the bearing in question that, as in the case of the old bicycle ball bearing, there is no separate function of cylinder bearing and thrust, and without doubt from a modern standpoint the type of bearing shown in Figs. 8 and 9 would be considered lacking in durability. No trouble was experienced from expansion, due to temperature, as between the two thrust bearings, and it is fair to regard the casing, as indeed the whole of the parts, as sufficiently elastic to take up any small temperature difference. It is possible that at times one thrust bearing is called upon to sustain more thrust and at other times less than its fellow, but there has been no actual evidence of this taking place.

The worm wheel bearings shown in Fig. 10 are roller bearings of the cheese roller type without cake of any kind. These are in fact the bearings on which the balance gear box is mounted, and the worm wheel itself forms the central section of the balance gear box. The thrusts were of a specially designed type, and consisted of balls in a flat cage between two perfectly flat ground and hardened thrust washers, the balls being arranged in a spiral manner, Fig. 11. The object of this arrangement, is that each ball may bear on a different part of the flattened surface, so distributing the wear; a further advantage is, that if the balls vary amongst themselves as to diameter, as is commonly the case, each ball will form its own race and will soon be taking its due proportion of the load—the markings on the thrust races frequently gave evidence of this action. The degree of inaccuracy amongst balls of nominally the same diameter is commonly less than one ten-thousandth of an inch. This form of bearing was in every way successful and satisfactory; that it has since been dropped is due to the fact that excellent thrust bearings have now been placed on the market by specialized manufacturers.

(To Be Continued)



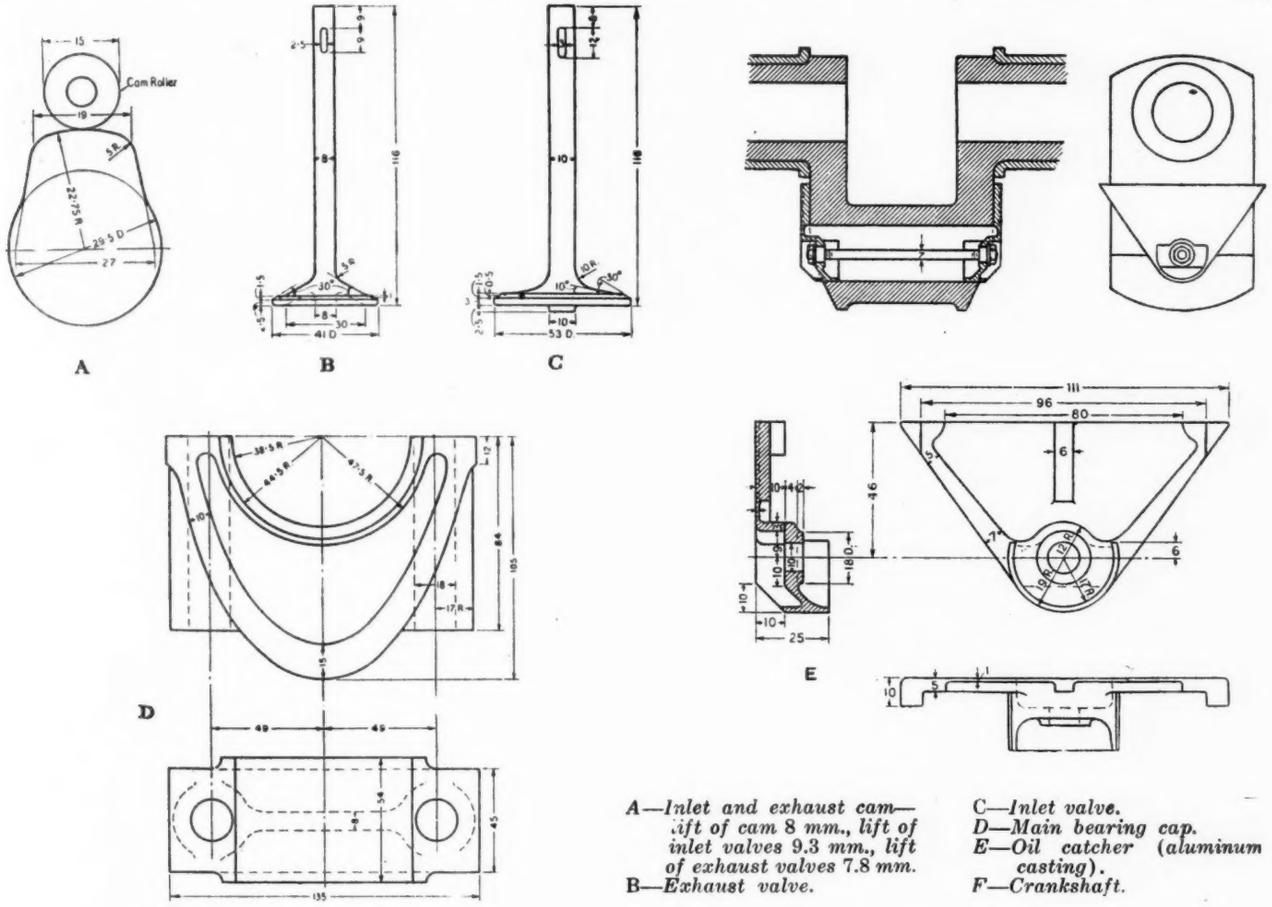
Of the tonneau windshields appearing on a number of cars at the salon and at the Palace show, the majority were made demountable in some way. This shield on the McFarlan was fitted as solidly as any front compartment glass. Combining rigidity and light weight it was also one of the best appearing, seeming to fit in with the body and not giving a makeshift impression

Zeppelin Power Plant Engineering

Part II

An Exhaustive Study of the Details of German Aircraft Engine Construction as Embodied in Zeppelins Recently Brought Down in England

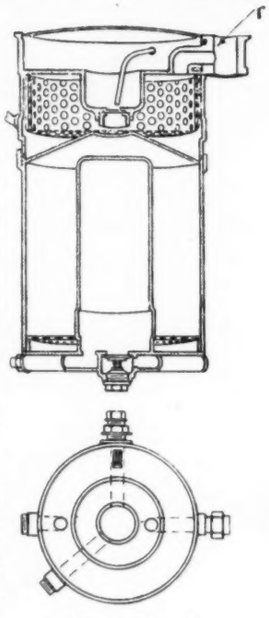
THE fitting in Figs. 11, 12 and 13 is in appearance a cylindrical vessel, and is bolted at its top to the rear end of the bottom half of the engine crankcase, as shown at A in Fig. 2. It is divided into two portions, absolutely separate, the top one being devoted to the oil filtration, and the lower one to the fuel system. The two portions presumably are located together merely for convenience—it may possibly be with the object of warming



A—Inlet and exhaust cam—lift of cam 8 mm., lift of inlet valves 9.3 mm., lift of exhaust valves 7.8 mm.
B—Exhaust valve.
C—Inlet valve.
D—Main bearing cap.
E—Oil catcher (aluminum casting).
F—Crankshaft.

the fuel, and at the same time to assist in cooling the oil. Into the side of the top half a pipe leads from the oil pump, and the oil, passing through the gauze filter, issues from the pipe that leads to the main bearings, Fig. 3.

The bottom portion of the device forms an air vessel and valve box for the pump used in the fuel supply system, and will be seen from Fig. 1 to be connected with the horizontal piston pump shown in Fig. 10. On its suction stroke the piston will cause the suction valve to open with a reduction of pressure in the chamber K, Fig. 1. Whatever may have been drawn by the pump through K will be forced, on the compression stroke of the piston, through into the larger chamber, from which there is a pipe leading to the reservoirs above the jets of the two carbureters. The pump, therefore, effects delivery of fuel, and the two chambers in connection with the valves are intended to equalize the flow inward and outward in a manner similar to the dome or "air vessel" used on many types of pumps, and commonly seen on the fire engine. As the pump in this case is situated at a little higher level than the air vessel, it is evident that no fuel actually reaches the piston, and that it is effectually pumped without connection with the pumping medium, the difficulty—or practical impossibility—of pumping liquid gasoline being fairly well known.



Above—Fig. 12
Below—Fig. 13

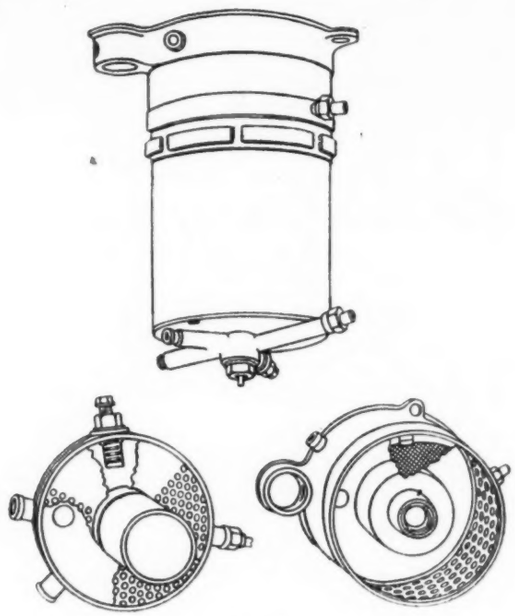


Fig. 14

Complicated Fuel Feed

In Fig. 9 is presented a diagram, and in Fig. 14 a perspective sketch of the mechanism that is in effect the float chamber. This device was carried beneath the base chamber, and well away from the carbureters. It consists of a cylindrical metal tank divided into two compartments, the lower being the larger. In the center of the bottom of the upper tank there is a tube depending well down into the lower one. This tube forms the only means of communication between the upper and lower chambers, and its lower portion makes a rough guide for a large float contained in the lower chamber. At its upper end there are two seatings for a double end needle valve. Normally this needle valve is held down on its lower seating by a coil spring. Provision is made that, as the lower tank is filled, the float rises, and a striker plate carried at its base, through the medium of a rod, lifts the needle valve up from its lower seat and causes the top point of it to close upon the seat. The striker rod that effects this is carried centrally on guides in the depending tube, and is divided in the middle, the halves being held apart by a coil spring presumably to give a cushioning as well as a "time" action to the mechanism, allowing the float a certain amount of travel before definite action takes place. The upper seating of the valve communicates with the upper tank, and is inclosed in a cylindrical gauze filter box. To the small chamber containing the needle valves, a pipe from the air vessel is connected, and, since suction from the pump takes effect upon the needle valve chamber, fuel will be caused to flow in from the pipe in the upper chamber of the fuel regulator. This fuel will flow through the lower portion of the chamber shown in Fig. 11, and up to the fuel reservoir in the carbureter, any surplus from the carbureter returning down the overflow pipe into the lower half, or float chamber. As soon as this float chamber fills, the float rises, and eventually lifts the double end needle valve off its lower seating until it closes instead on to the upper seating. The suction is thus transferred from the upper chamber to the lower one until the gasoline contained therein is used up and the float falls, allowing the needle valve to resume its normal position and the supply its normal flow. There remain two more inlets to the float chamber, one of these being connected to the second carbureter, and the other to a pipe carried sufficiently high to prevent leakage, but open at the end to provide an air vent to the float chamber. The fuel regulator device is made necessary by the system adopted for jet feed in the carbureter, a system probably arranged in view of the particular importance of avoiding fire dangers on an airship. The carbureter proper thus contains a minimum of fuel, the bulk supply in the float chamber being well removed from the danger zone of the engine by location beneath the base chamber. The arrangement employed also uses up any surplus that overflows through the jet feed.

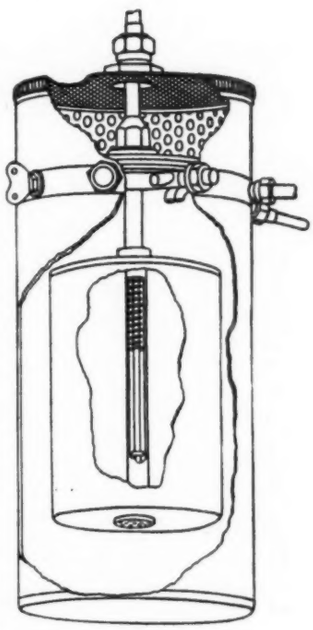
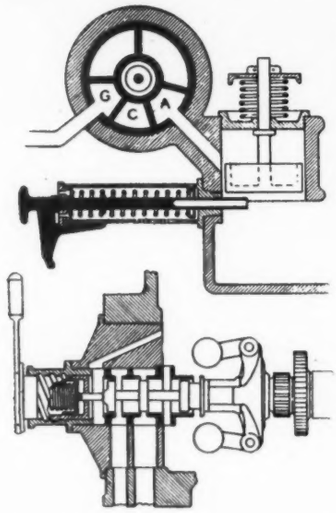
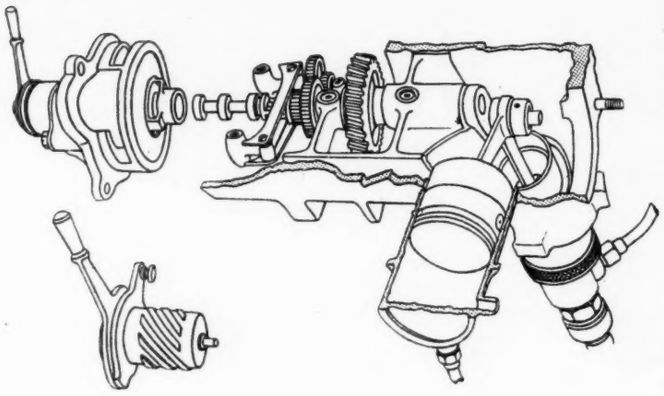


Fig. 15

In Figs. 1, 15 and 16 are shown the essentials of a system intended to prevent the engine running if the pressure of oil in the lubricating system fails. Inside the crankcase is a short cylinder open at the bottom end and containing a short piston, the rod of which passes through a guide in the cylinder cover and terminates in a collet between which and the cover there is a compressed coil spring. This spring endeavors always to draw the piston upward into the cylinder on to a stop on the piston rod, the travel on the piston being limited to about three-eighths of an inch. Above the piston a port is provided in the cylinder wall; this leads to a port A, in a circular casing, the center of which forms the cylinder barrel of a triple piston slide valve, shown in section in the lower diagram of Fig. 15. In the one position of the piston valve, the port A is in direct communication through the circular distributer body with the second port G, and G is connected by a pipe to the outlet in the top half of



Left—Fig. 16



Above—Fig. 17

the device shown in Fig. 11; that is to say, in brief, that any pressure in the oiling system is communicated to the cylinder and tries to force the piston downward. Bolted horizontally into the crankcase beneath this cylinder is a case containing a spring-loaded plunger, the formal position of which is with the rod projecting into the sump as far as it will go. This plunger case is so placed in the crankcase that the rod just clears the piston when the latter is in its highest position. At the outer end of the plunger is a striking arm that engages the end of a small laminated spring fastened to a rocker shaft connected by a series of bell crank levers and rods with the quick thread rising jet damping device shown beneath the jet hole in the diagram of the carbureter. With the plunger in its normal position—that is, projecting inward to the crankcase well under the piston in the manner shown—the dampers are lifted and the jet holes closed, or nearly so, according to the adjustment. An arrangement is provided on one side of the engine bearers whereby the plunger rod can be drawn outward by hand, so that the jets are opened.

The operation is probably as follows: Before the engine can be started up the plunger rod must be drawn by hand outward in order to open the jet dampers. When the engine is started, so soon as pressure exists in the lubrication system, the piston will be forced downward opposite the interior end of the plunger rod, so that if the grasp on the latter be released it will move inward only a short distance, because the interior end of the plunger rod will strike against the side of the piston. So long, therefore, that pressure in the lubrication system is maintained, the dampers will be held off the jets, but if pressure fails, the piston will rise under the influence of its spring, and disengage the end of the plunger rod so that the latter will fly inward, and in so doing cause the jet dampers to cut off the fuel supply in the mixing chambers.

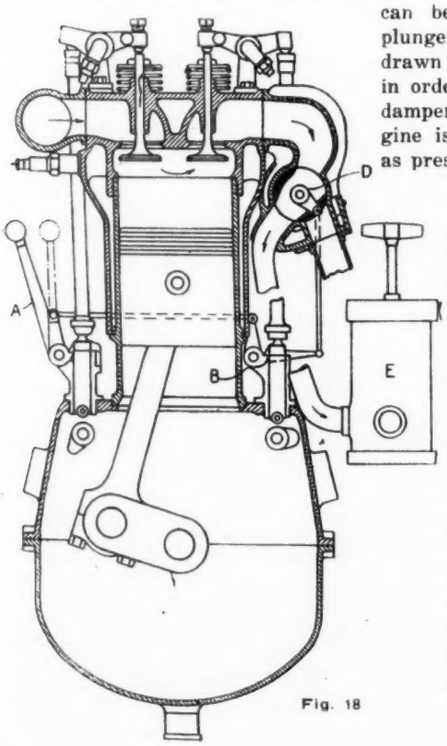


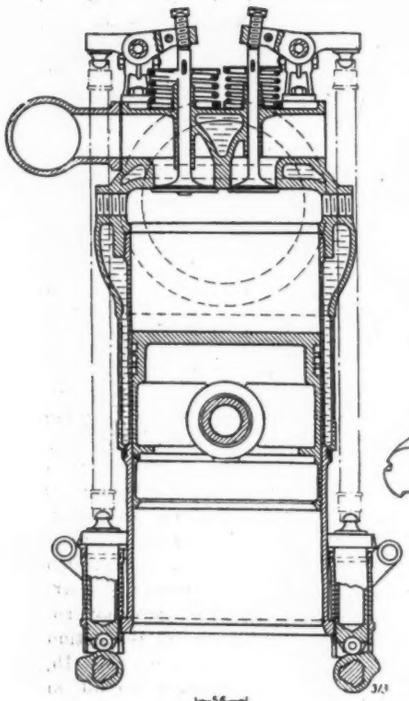
Fig. 18

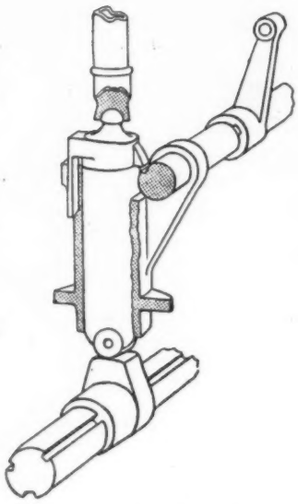
With regard to the triple piston valve contained in the circular distributer body, a section of which is given at the bottom of Fig. 15, this consists of a rod with three narrow pistons mounted on it inclosed in a tube, in the circumference of which two grooves are cut, each groove being in communication with a port. The rod ends in a fork which engages with a small centrifugal governor driven by gearing from the crankshaft (see Fig. 16). The governor rotates the rod and can slide it to and fro against the action of a spring-loaded plunger, shown in the left of Fig. 15, which is carried in a case having a quick pitch thread on its circumference, and can be regulated by the lever as to its strength. The normal position of the piston valve rod is such that ports G and A communicate. As the speed of the governor increases, the tendency is to force the rod to the left, thus cutting off port A from port G, and putting port A in communication with the interior of the crankcase through the port C, so that the pressure behind the piston is released and the jet dampers brought into action. The port to the left of the piston valves prevents a dashpot action. It is probable that, although the governor may be set to cut out the jets when the engine exceeds a predetermined speed, yet between the definite jet cut off, or minimum oil pressure, and the maximum oil pressure, there exists a certain range, and it is to regulate or control the oil pressure within this range that the hand setting to the oil governor is provided.

Starter Details

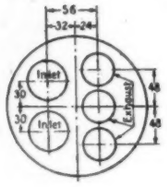
With regard to the self-starter scheme, by means of the lever A on the inlet side of the engine, as shown in the diagrammatic cross section of the engine, Fig. 17, all the tappets are lifted off their cams by the small lifting cam B, the lip of which engages with the small triangular projection on the head of the tappets when the hand lever A is depressed. The details of this lifting machanism are clearly shown in Fig. 18. All the valves, both the inlet and exhaust, are thus opened in the cylinder head, and at the same time the lever A, by a connection of levers, closes the exhaust passage to the muffler by partially rotating the water-cooled barrel valve or exhaust throttle D.

The exhaust ports and the outlet in the exhaust manifold are consequently in communication with the secondary outlet pipe that leads to a large suction hand pump E, by which gas is sucked into the cylinders from the two carbureters through all the inlet valves, as indicated in Fig. 17, showing the engine with all the valves open. When the cylinders are charged, the valves are returned to their normal positions by the lever A, and the vale D automatically opens the exhaust outlet to the silencer in the normal running position and closes the pipe leading to the suction pump E. Ignition is then effected by means of a geared-up Bosch hand-starter magneto.





Above—Fig. 19
Left—Fig. 20



Normal ignition is by two Bosch magnetos—type 2H6—supported on a duplex bracket extension of the crankcase in front of the engine, the magneto being driven by spur gearing off the crankshaft bevel gear that also drives the water accelerator.

Two Bosch spark plugs per cylinder are fitted, one on each side of the cylinder, the plugs being screwed into the combustion chamber directly below the valves, as can be seen by reference to sketches 17 and 18.

The following are a few figures in connection with the engine:

Stroke/bore ratio	1.266 :1	
Stroke volume of one cylinder	3,357.58 cu. cm.	204.8 cu. in.
Total stroke volume of engine	20,145.48 cu. cm.	1,228.8 cu. in.
Area of one piston	176.715 sq. cm.	27.40 sq. in.
Total piston area of engine	1,060.29 sq. cm.	164.40 sq. in.
Clearance volume of one cylinder	680.00 cu. cm.	41.48 cu. in.
Piston speed	1,495 ft. per min.	
Brake mean effective pressure	107.4 lb. per sq. in.	
Cu. in. of stroke vol. per b.hp.	6.15 cu. in.	
Sq. in. of piston area per b.hp.	0.822 sq. in.	
Hp. per cu. ft. of stroke vol.	282 b.hp.	
Hp. per sq. ft. of piston area	175.4 b.hp.	
Area of inlet valve ports (each)	18.09 sq. cm.	2.80 sq. in.
Total inlet valve port area per cyl.	36.18 sq. cm.	5.60 sq. in.
Max. lift of inlet valves (h)	9.3 mm.	0.366 in.
Area through each inlet valve ($\pi d h$)	14.024 sq. cm.	2.175 sq. in.
Total area through inlet valves per cylinder	28.048 sq. cm.	4.350 sq. in.
Gas velocity through inlet valve ports	122 ft. per sec.	
Gas velocity through inlet valves	157 ft. per sec.	
Ratio of piston area/area through inlet valves	6.3 :1	
Area of exhaust valve ports (each)	9.621 sq. cm.	1.49 sq. in.
Total exhaust port area per cylinder	28.86 sq. cm.	4.47 sq. in.
Max. lift of exhaust valves (h)	7.88 mm.	0.310 in.
Area through each exhaust valve ($\pi d h$)	8.66 sq. cm.	1.342 sq. in.
Total area through exhaust valves per cylinder	25.98 sq. cm.	4.026 sq. in.
Gas velocity through exhaust valve ports	153 ft. per sec.	
Gas velocity through exhaust valves	170 ft. per sec.	
Dimensions of crank webs	96 × 25 mm.	3.78 × 0.98 in.
Bearing, flywheel end	90 × 66 mm.	3.54 × 2.60 in.
Projected area	59.4 sq. cm.	9.2 sq. in.
Other bearings (6)	64 × 66 mm.	2.52 × 2.60 in.
Projected area (each)	42.24 sq. cm.	6.54 sq. in.
Total projected area of crankshaft bearings	312.84 sq. cm.	48.45 sq. in.
Crank pin bearings, (each)	72 × 66 mm.	2.83 × 2.60 in.
Projected area	47.50 sq. cm.	7.36 sq. in.
Gudgeon pin bearing	110 × 38 mm.	4.33 × 1.49 in.
Projected area	41.80 sq. cm.	6.48 sq. in.
Length of connecting rod between centers	312 mm.	12.282 in.
Ratio of connecting rod to crank throw $1/r$	3.29 :1	
Number and diameter of big end bolts	Four 14 mm.	0.551 in.
Diameter of camshaft	21 mm.	0.826 in. (diam. over splines)
Number of camshaft bearings	5	

WEIGHTS OF VARIOUS PARTS

	Kilos.	Lb.
Crankshaft, complete with camshaft drive pinion, bevel gear for driving water pump, and worm for driving cross-shaft for oil pump, etc	45.00	99.208
Steel flywheel	30.40	67.02
Piston, complete with gudgeon pin and rings	4.92	10.84
Gudgeon pin	0.67	1.476
Connecting rod complete	4.895	10.78
Weight of reciprocating part of connecting rod	1.75	3.86
Total weight of reciprocating parts per cylinder	6.67	14.70

The following test results of the material employed in the engine are of certain interest.

The crankshaft steel gives Brinell numbers as follows:

Front web	No. 285 = 65 tons steel
Rear web	No. 321 = 72 tons steel

Tensile and impact pieces prepared from the cylinder holding-down bolt give the following:

Yield point	52.85 tons per square inch
Maximum stress	58.65 tons per square inch
Elongation on 1.41 in	19.15 per cent
Reduction of area	52.6 per cent
Brinell hardness	No. 271
Impact	20.5 ft. lb.

A test from a portion of the aluminum crankcase gives the following:

Maximum stress	9.1 tons per square inch
Elongation on 2 in	1.5 per cent
Elongation on 4 in	1.25 per cent
Reduction of area	3.24 per cent
Bend through	11 deg. broken

The following results were obtained on analysis:

ALUMINUM

Zinc	12.34 per cent
Copper	1.06 per cent
Iron	0.86 per cent
Silicon	0.47 per cent
Aluminum	85.27 per cent

Inlet valve spring contains no vanadium.
Exhaust valve: Vanadium present (percentage small).

Use of Fused Silica for Engine Parts

IT has been reported that fused silica has been employed in Europe for certain parts of aviation engines. The rumor is that cylinder heads have been made of this material, which, of course, has some rather remarkable properties.

Fused silica is somewhat unique in the way of materials, as although it is glass-like in appearance it is, in reality, very highly refractory, possessing at the same time the lowest known coefficient of expansion. As a comparison of its expansion coefficient, it is useful to compare it with glass, the exact figures being 0.0000085 for glass and 0.00000054 for fused silica, which makes the silica roughly 1/16 the expansion of glass.

The low coefficent of expansion is, of course, the underlying reason for the remarkable resistance of this glass-like product to changes of temperature, and nothing is more surprising than the usual laboratory demonstration of taking a piece of fused silica, making it white hot and then plunging it into cold water without breakage occurring.

The low coefficient, while an advantage as far as temperature resistance is concerned, is a positive disadvantage in making up composite metal and fused silica devices, as the metal parts expand and contract with changes of temperature, while the silica remains the same, despite the temperature changes.

Removing Kerosene from Oil

Suggests Exhaust Jacket and Radiator for Lubrication System To Remove Dissolved Fuel—Possibilities of Oil for Cylinder Cooling—May Need Temperatures Above 212 Deg. Fahr. in Jackets

By A. Ludlow Clayden

IN this issue of THE AUTOMOBILE two contributors make mention of the possibility of running an engine with a jacket temperature in excess of 212 deg. Fahr., with the idea of obtaining better efficiency with kerosene fuel. Each suggests the possibility of placing a safety valve on the radiator and carrying such steam pressure as will serve to raise the boiling point of the water a few degrees. If these letters are straws to show the way the wind is blowing, and there is plenty of good reason so to regard them, all sorts of possibilities are opened up.

Uses Oil Jacket

The Hall-Scott aviation engine is unique in that it has an oil jacket round the intake manifold, while using water in the cylinder jackets, thus cooling the oil and warming the gas proportionally, and there are now several cars in which provision is made for oil cooling. Still, neither the latter nor the Hall-Scott device provides an oil temperature control. The thermostat will easily control cylinder jacket temperatures accurately, and it could be adapted to control oil temperatures by giving the oil a separate cooling system modeled upon the water system, and it might be possible for the two ideas to be combined by using oil instead of water, the same body of lubricant serving in the bearings and in the jackets. The most obvious trouble is that oil for lubricating should be as cold as is consistent with requisite fluidity, while most oils are too thin at 200 deg. Fahr. or less.

Oil Must Be Changed

With kerosene as fuel there is need for changing the oil with considerable frequency, because the kerosene condenses a little in the cylinders and, by dissolving in the oil, cuts down the lubricating power. Oil thus denatured can be restored by boiling off the kerosene or by maintenance of a temperature sufficient to evaporate the kerosene for sufficiently long, so it is conceivable that the crankcase oil might be continuously freed from kerosene by passing it through the cylinder jackets, having a sufficiently high thermostatically controlled temperature in the jackets.

These things are not *probabilities*, but they are *possible* nuclei for the development of something practical.

Immediately temperatures higher than 212 deg. Fahr. are thought of there comes naturally the notion of the air-cooled engine. So far this has not been tried out to any extent for kerosene, and the writer is not aware of any accurate means for controlling the temperature of a motor of this sort within fine limits, although the principle of the thermostat must be perfectly applicable to air cooling. With an air-cooled engine the distillation of kerosene from the oil might conceivably be accomplished by passing the oil through a jacket on the exhaust pipe and cooling in an intake manifold jacket followed by passing through a small radiator perhaps, could restore the oil to its best lubricating condition before it was readmitted to the bearings. Again this is a purely visionary idea, very probably quite impractical.

Elaborate Oil Cooling

Returning to the oil-cooled engine idea. Supposing a cooling system like an ordinary thermostat-controlled water system, we might add to it the exhaust jacket for keeping the oil free from light petroleums in solution somewhat as follows: Oil could be taken from the bottom of the radiator, which would be much the same as the water radiator. This oil would be cool and could go straight to the bearings. From the crankcase sump a second pump could force it through the exhaust jacket, returning it to the top of the radiator in a hot condition, via an intake manifold jacket. Meanwhile the circulation through the cylinder jackets, controlled by a thermostat, could proceed independently. The only thing necessary to insure a supply of cool oil to the bearings would be a large enough radiator, and practically the only complication added would be the second pump for exhausting the crankcase. Just how fast and how frequently the oil needs to be heated up in the exhaust jacket is purely problematic.

In this connection reference may be made to some researches made in 1914 by Dr. Ormandy of Great Britain. Dr. Ormandy examined a large number of samples of used and unused lubricating oils and found in every case that the used oil contained light fractions which could only come from the fuel employed. With respect to an oil heavily contaminated with kerosene, he suggested that heating combined with agitation at about 300 to 400 deg. Fahr. ought, in the light of his experiments, to restore the oil to its original condition. Such heating would be easy in an exhaust jacket.

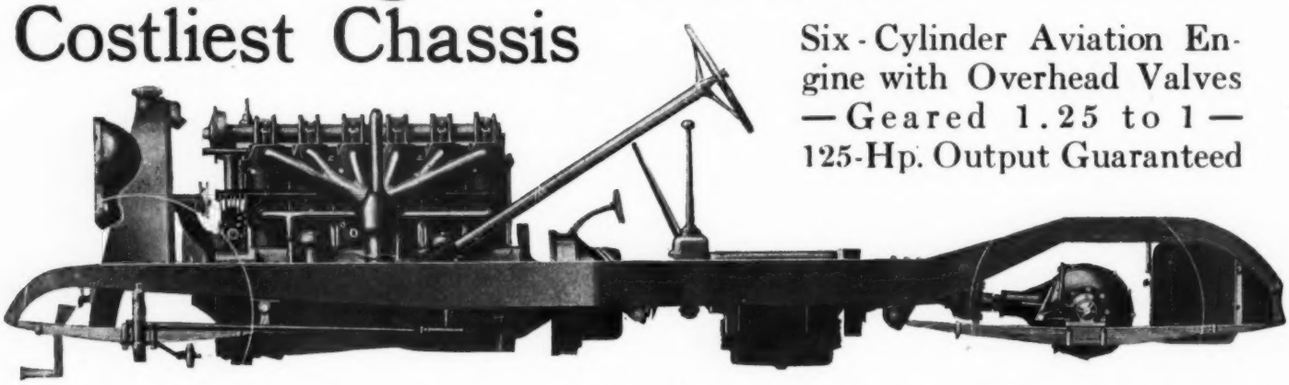
Must Keep Oil Pure

The writer has hesitated a little in making what seems at first sight to be so extraordinary a suggestion and would point out that he has not the passenger car so much in mind as the tractor, of which the lubrication troubles were so expressly mentioned by W. L. Horning in his recent S. A. E. paper. On a tractor the big radiator which would probably be necessary in connection with so comparatively poor a heat carrier as heavy oil, would be no serious disadvantage. Even if water or air cooling was used for the cylinders, the extra complication of the "oil boiler" and oil radiator might conceivably be worth while.

There is just one thing certain, and this is that we are not going to be able to run the ordinary engine on kerosene without some means for keeping the oil free from contamination. It is also highly probable that a temperature above 212 deg. Fahr. will be found to give the greatest economy. Yet again we need to have the valves as cold as possible and the spark plugs similarly well cooled. The conditions are antagonistic, they exist to some extent in a gasoline engine, but it is possible to strike a happy mean with gasoline so that the conventional water and oil systems are quite efficient enough. Of course, we may find that kerosene can be handled by purely mechanical means so that deposition in the cylinders is completely prevented, either by vaporization or atomization, and then the conventional oiling system will be satisfactory. At present, however, we do not seem to have discovered how to prevent a steady thinning down of the oil in tractor engines which, incidentally, being always at full throttle, are working under the condition where condensation is least aggressive. If tractor engines were required to run much at low throttle the use of kerosene with a recirculatory lubrication system would probably be very nearly impossible.

130-Hp. Fageol Is America's Costliest Chassis

Six-Cylinder Aviation Engine with Overhead Valves —Geared 1.25 to 1— 125-Hp. Output Guaranteed



IT has been demonstrated on numerous occasions that the employment of a high-speed, light-weight aeronautical engine in an automobile chassis makes an ideal combination where performance alone is considered. Hitherto combinations of this kind have been merely of an experimental nature. There is now on the market, however, and will be on exhibition at the Chicago show, a chassis of this kind which is a stock job. It is the product of the Fageol Motors Co., Oakland, Cal., and sells in chassis form at $9,500. Any body work in connection with the chassis is additional and is, of course, optional with the purchaser.

The engine employed is the Hall-Scott aviation power plant. The class of service for which an engine of this type is adapted may be shown by a recent test in which this six-cylinder unit was run continuously for 64 hr. at 1300 r.p.m., developing 130 b.h.p. The weight of the engine is 560 lb., and it is guaranteed to produce 125 hp. at 1300 r.p.m. This is a horsepower for every 4½ lb. of engine weight and for every 6.6 cu. in. of piston displacement. The total piston displacement is 824.67 cu. in.

Like the majority of aviation engines which are being turned out at the present time, this is an overhead-camshaft type. It is not a V-engine, however, but a vertical design of six cylinders, having a bore and stroke of 5 by 7 in. The cylinders are cast separately, but are machined on the sides so that when assembled they form a solid block and to all appearances are block cast. The material for the cylinders is Swedish gray iron.

Swedish Iron Pistons

Swedish iron, known frequently as semi-steel, is also used for the pistons. These are made very light, but with the necessary strength and rigidity secured by a system of deep ribbing under an arched head. There are six of these deep ribs, which not only help in strengthening the pistons but serve to carry the heat away from the piston head. The piston pin bosses are located rather low on the piston to keep the heat away from the upper connecting-rod bearing.

Solid chrome-nickel-steel forgings are used for the connecting-rods, with a gunmetal bushing at the piston pin end and a double bronze bushing carried in serrated shells at the crank end. These bronze shells are tinned and babbitted while hot. Adjustment is provided by placing laminated shims between the cap and the rod. To keep the rods light they are milled and machined all over.

A seven-bearing crankshaft is used machined from a heat-treated drop forging of chrome-nickel steel having a tensile strength of 275,000 lb. per square inch. The diameter of the shaft at the bearings is 2 in., and all but the front and rear bearings are 1 15/16 in. long. The rear main bearing is 4¾ in. long and the front main bearing is 2 3/16 in. The timing gears and starting pinions are bolted to a flange which is turned integral with the shaft.

Overhead Valve Operation

From the crankshaft the valve drive is carried to the overhead camshaft by means of a vertical shaft in connection with bevel gears. The camshaft is inclosed in an aluminum housing bolted directly to the tops of the cylinders. It is a one-piece design with the twelve cams integral, and the flange through which the shaft is driven is also an integral part of the forging. The material used in the shaft is low-carbon steel with a small nickel content, and the shaft is carried on four large bearings, each lined with Parsons white brass. The valves are operated by short chrome-steel rocker arms, with hardened steel roller followers on the cam end and tool-steel adjusting screws on the opposite end. The diameter of the valves is quite large, being 2½ in., or one-half the cylinder diameter. They are seated directly in the cylinder heads, fitted with large-diameter springs held in tool-steel cups, and locked with a key through the valve stem. The valve ports have been kept large in proportion with the valves, giving free inlets and outlets for the gases. The material used for the valves is tungsten steel.

Both oil and water are used in the cooling system. The oil is circulated around a long intake manifold jacket, helping keep the crankcase heat at a minimum at all times and warming the intake. Uniform temperature of the cylinders is maintained by the use of internal outlet pipes running through the heads of each of the six cylinders. Slots are cut in these pipes so that the cold water is drawn directly around the exhaust valve. Surrounding the cylinders, the water jackets are large, with 2 in. of water space being left above the cylinder head. The water circulation is maintained by a centrifugal type of pump.

High-Pressure Oiling

High-pressure oiling is used, with a large gear pump located in the oil sump in the bottom of the crankcase. The oil is first drawn from the strainer in the oil sump to the long oil jacket around the intake manifold, and then forced by pressure, which varies according to the motor speed from 5 to 30 lb. to the square inch, to the main distributor pipe in the crankcase. On the crankshaft there are pinned steel oil scuppers which carry the oil to the lower connecting-rod bearings. The camshaft-drive mechanism is oiled by forcing the oil into the front end of the shaft, allowing the shaft itself to act as a distributor, and the surplus oil flows back to the crankshaft through a hollow vertical tube located at the rear of the crankcase housing. This supply also oils the magneto

and pump gears. Aluminum alloy is used in the construction of the crankcase, the lower half of which can be removed without breaking any of the oil-line connections.

Two Magnetos Furnish Ignition

For ignition two six-cylinder magnetos are used mounted on the opposite ends of a cross-shaft at the forward end of the engine. This gives two independent ignition systems with independent spark plugs, so arranged that one system can be completely out of commission without interfering with the functions of the other. A double Zenith carbureter with a single float is used with the unique feature mentioned, that the jacketing around the carbureter manifold is filled with the warm crankcase oil, thus serving to aid in the vaporization of the fuel as well as to reduce the heat of the crankcase. The arrangement of the intake manifolding should be noted. This is shown in the view illustrating the right side of the engine, and it indicates the jacketing connections with the double carbureter and the balanced form of intake manifold.

Referring to the chassis views, it will be seen that the engine is mounted on a subframe which is extended back to carry the gearset and clutch. Behind the gearset the length of the driveshaft is exceedingly short. The greater part of the distance between the rear axle and the engine is taken up by the clutch housing and by the transmission members. The clutch is a Hele-Shaw of standard form, with regulation V-grooved twin plates of phosphor-bronze operating against steel plates in a bath of oil. This is inclosed in an oiltight housing back of the flywheel, and connects with the main shaft of the gearbox through a universal coupling.

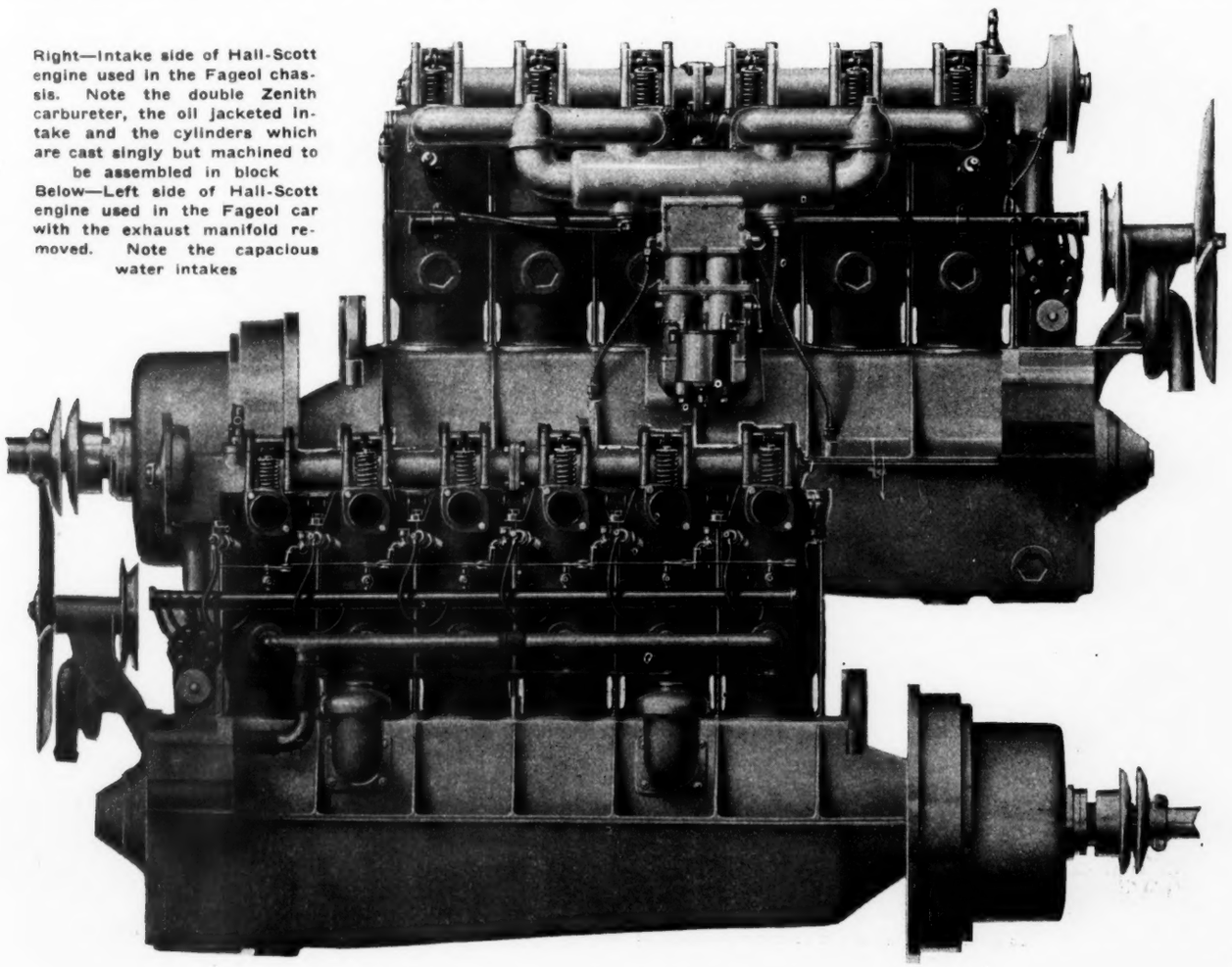
The gearbox is entirely a Fageol design mounted in a bronze and aluminum case cast in three parts. The box provides three speeds forward and reverse, and the ratios are such as to provide 5 to 1 on first, 2½ to 1 on second, and 1¼ to 1 on third. The novel feature of the case is that the main box and the supporting arms are of manganese bronze and so arranged that the main shaft and countershaft, mounted one above the other, are just half within the case, as shown in the illustration. Manganese bearing caps are put in a position completely encircling the bearings. Chrome-nickel studs extend vertically through the aluminum case, taking up twisting and torsional stresses.

Gears and Bearings Accessible

The upper section of the case is cast integrally with the brackets and forms a housing for the shifter lever, shifting mechanism and emergency brake lever. The object of this form of case is to permit a thorough inspection of the gears and bearings by simply removing either the upper or lower section of the case. Chrome-nickel-steel shafts and gears and annular ball bearings are used throughout.

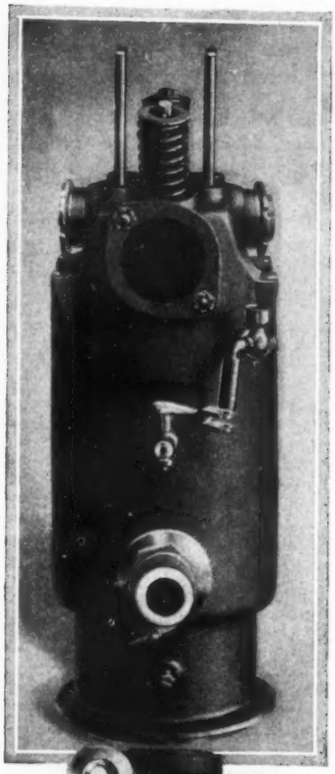
A semi-floating rear axle is used, with the shafts carried on Bock taper roller bearings and with chrome-nickel steel used for the driving members. The front axle is an I-beam drop forging from chrome-nickel steel. The brake layout has been given particular attention, with the foot brakes mounted on 16-in. ribbed drums bolted on the rear wheels and the hand brake operating against the 12-in. ribbed drum on the main transmission shaft just back of the gearbox. The springs are semi-elliptic, and also of chrome-nickel steel.

Alloy pressed steel is used for the chassis frame. This is

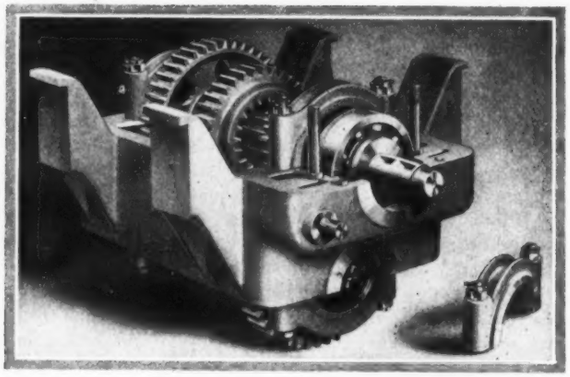


Right—Intake side of Hall-Scott engine used in the Fageol chassis. Note the double Zenith carbureter, the oil jacketed intake and the cylinders which are cast singly but machined to be assembled in block

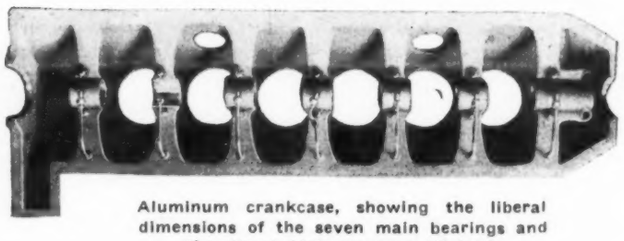
Below—Left side of Hall-Scott engine used in the Fageol car with the exhaust manifold removed. Note the capacious water intakes



Left — Piston and connecting-rod assembly as used in the Hall-Scott installation in the Fageol chassis

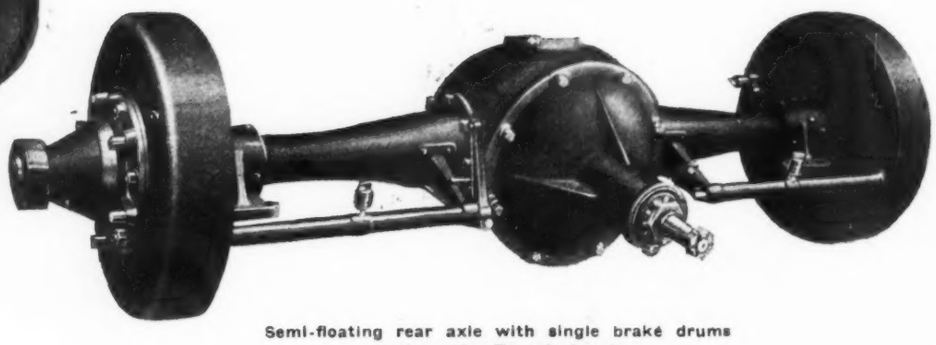


Above—Built up gearbox of manganese bronze and aluminum designed to give the maximum accessibility for the gearbox assembly

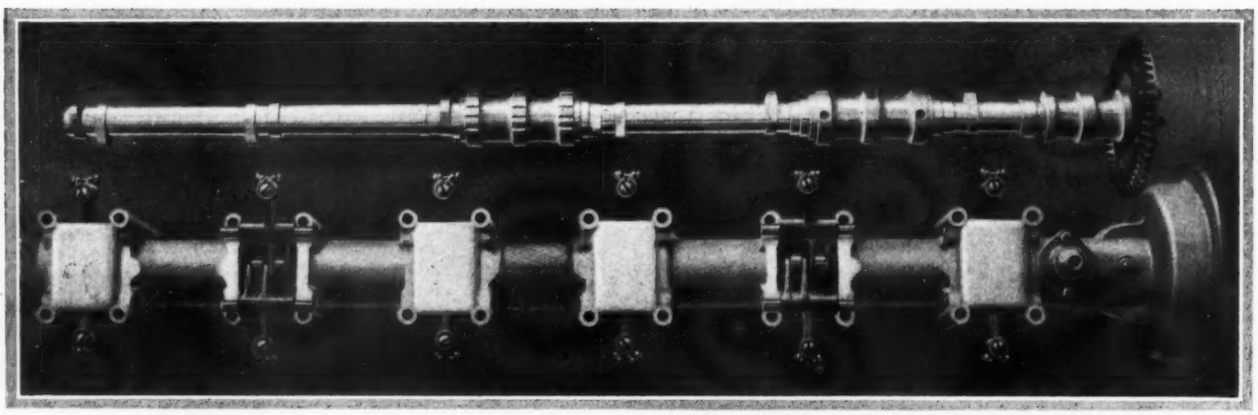


Aluminum crankcase, showing the liberal dimensions of the seven main bearings and the direct high pressure oil leads

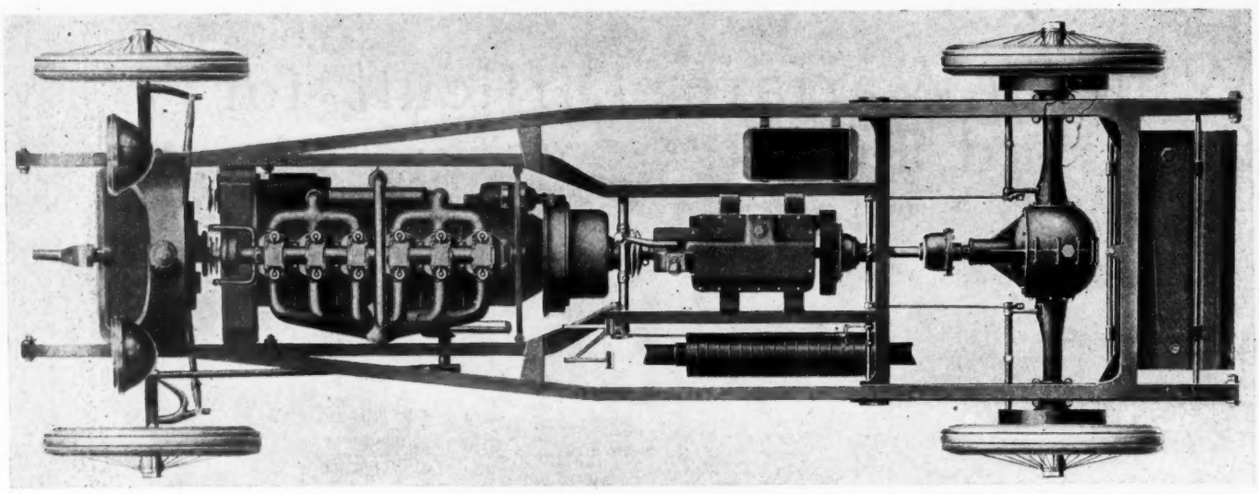
One of the single-cylinder castings of the Hall-Scott engine showing the valve position



Semi-floating rear axle with single brake drums used on the Fageol chassis



Camshaft and camshaft housing showing the method of supporting the rocker rods on the Hall-Scott engine



Fageol chassis, showing unusual tapered frame and elaborate subframe construction with tilted radiator. Note transmission brake

a special design best understood by a study of the plan view of the chassis given herewith. The side rails are 2 in. wide and 6½ in. deep, with the forward end narrowed down to 29 in. to permit of easy turning. The main sills of the frame are directly under the main sills of the body, with the front and rear springs directly under the main-frame members. The wheelbase is 135 to 145 in., according to the body model desired.

A feature of the radiator is that it is carried on a slant of 15 deg. This is not only for appearance, but greater cooling efficiency is claimed, because the air is forced through the radiator with greater friction than is possible with the vertical type. The steering gear is especially built for the Fageol car, and is bolted directly to the subframe, with the bell crank extending directly through the subframe member. A secondary support is secured in the aluminum dash, which provides for adjustable rake of the steering column to fifty individual requirements.

Quadrant Levers Ivory Mounted

Left drive is used, with the steering gear directly in front of the driver and the control levers designed to be in such a position that the driver will naturally drop his hand from the steering gear to the emergency brake or the gear-control lever. Ivory mounting is used for the levers in the quadrant, which is at the center of the wheel.

Starting and lighting is by a 12-volt system, with the headlamps mounted on the radiator. The engine is illuminated by two special lights when the bonnet is raised, and the taillight is so designed as to particularly throw the light on the rear license plate.

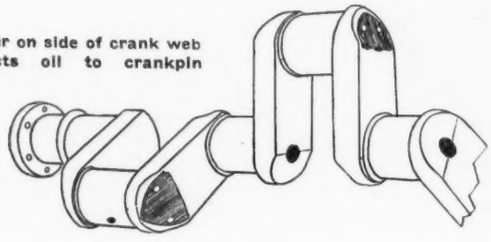
Copper is used for the 25-gal. gasoline tank, the material being formed from twelve-gage sheeting and the tank fitted with a magnetic gage indicating the extent of the gasoline supply. The wheels are wire, with plain clincher rims and fitted with 34 by 4½-in. cord tires. Two complete spare tires and wheels are provided.

One or two features about the bonnet are exclusive, particularly the ventilation, which is protected by patent applications. There are six triangular curved ventilators which are designed to clean out the air beneath the hood. These projecting ventilators start with a line flush with the top of the hood and tilt upward and backward for a length of 6 in. The rear opening may be closed at will with a waterproof door controlled by a lever on the dash, making the hood entirely waterproof. Another individual feature on the bonnet is the use of vault lock latches. The handles of these are ivory and the latches are always under spring tension to prevent rattle.

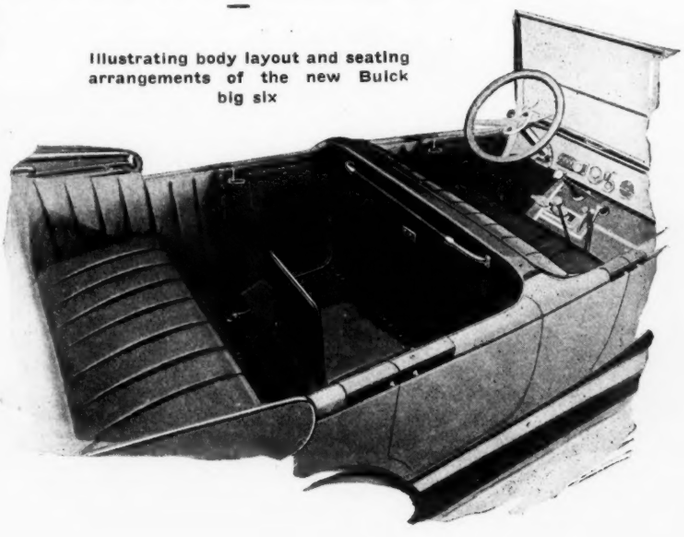
Other Special Features

The instrument board is also patented, and is in the form of a single panel through which the recording hands of the different instruments extend and over which a single piece of plate glass is fitted. The windshield is a special design and is claimed to be entirely rainproof. The glasses lap over each other by 3 in. when they are entirely closed. At the back of the body there is a substantial luggage carrier made of bronze and brass, hand-finished and nickel-plated. All the tools are made of high-grade steel, and nickel-plated socket wrenches are provided to fit every bolt in the entire engine and chassis. The tools are mounted in flush-line receptacles, and when the tool-box lid is opened a table is formed with all the tools in their places and ready for use; the box is designed so that it is automatically lighted.

Catcher on side of crank web conducts oil to crankpin



Illustrating body layout and seating arrangements of the new Buick big six



Winter Warfare Difficult for Cars and Trucks

1

2

3

1—*Speeding to the rescue of the survivors of the Tara, a liner sunk by a submarine off the north coast of Africa. One of the Duke of Westminster's armored cars following the Duke while crossing the desert in this expedition*

2—*An Austrian truck stuck in the mud on the Serbian frontier had to be extracted from its predicament by fifty soldiers*

3—*French staff officers' convoy held up by a snow blizzard on the heights of the Meuse during the Verdun fighting. Car after car broke down in holes made by shells but which were hidden by the level snow. The officers are trying to keep warm while the chauffeurs work on effecting temporary repairs to their cars*

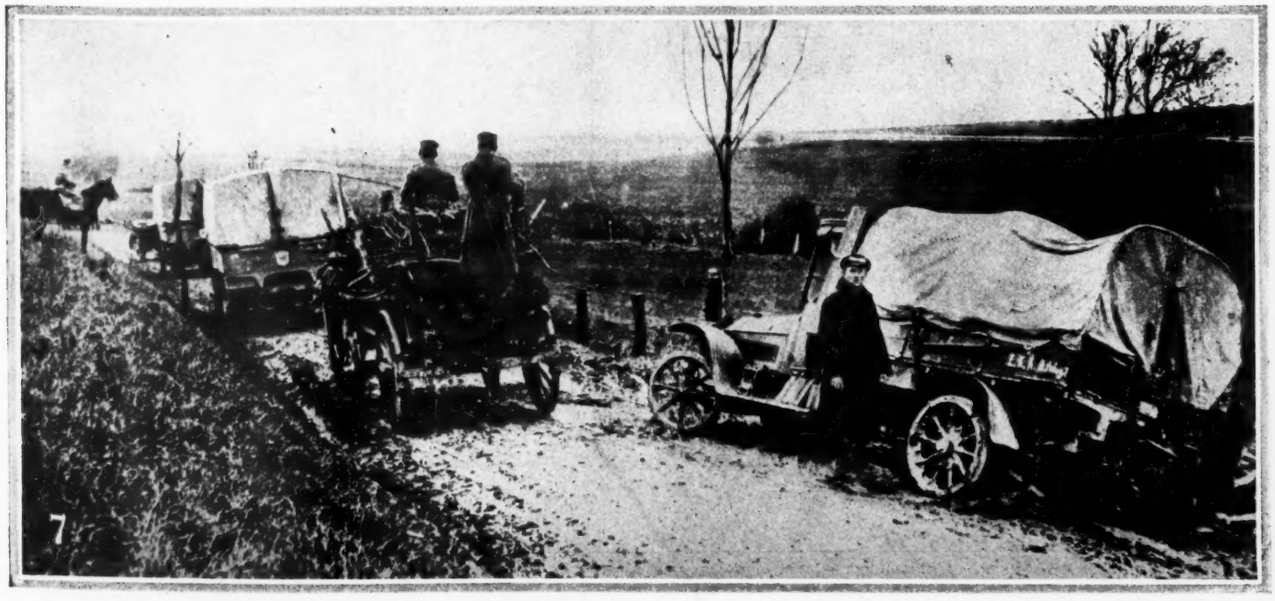
Photographs by Underwood & Underwood

4—German staff officers pushing their car, which has become mired in the muddy Serbian roads. Owing to recent incessant rains, roads in this section are in a terrible condition and cars sometimes founder beyond redemption in the mud

5—One of a convoy of French motor trucks having difficulty in the deep snow and mud on the heights of the Meuse. It is necessary to proceed cautiously in this neighborhood, as shell holes in the road are hidden by the snow

6—A British army service corps motor truck which skidded off the road into a ditch just behind the firing line in northern France

7—A line of German army trucks held up in a hurried race to the firing line in northern France by one of the number sinking deeply into the mud which characterizes the roads in this section, now badly broken by heavy traffic and wintry weather



Improved Church Fuel Feed

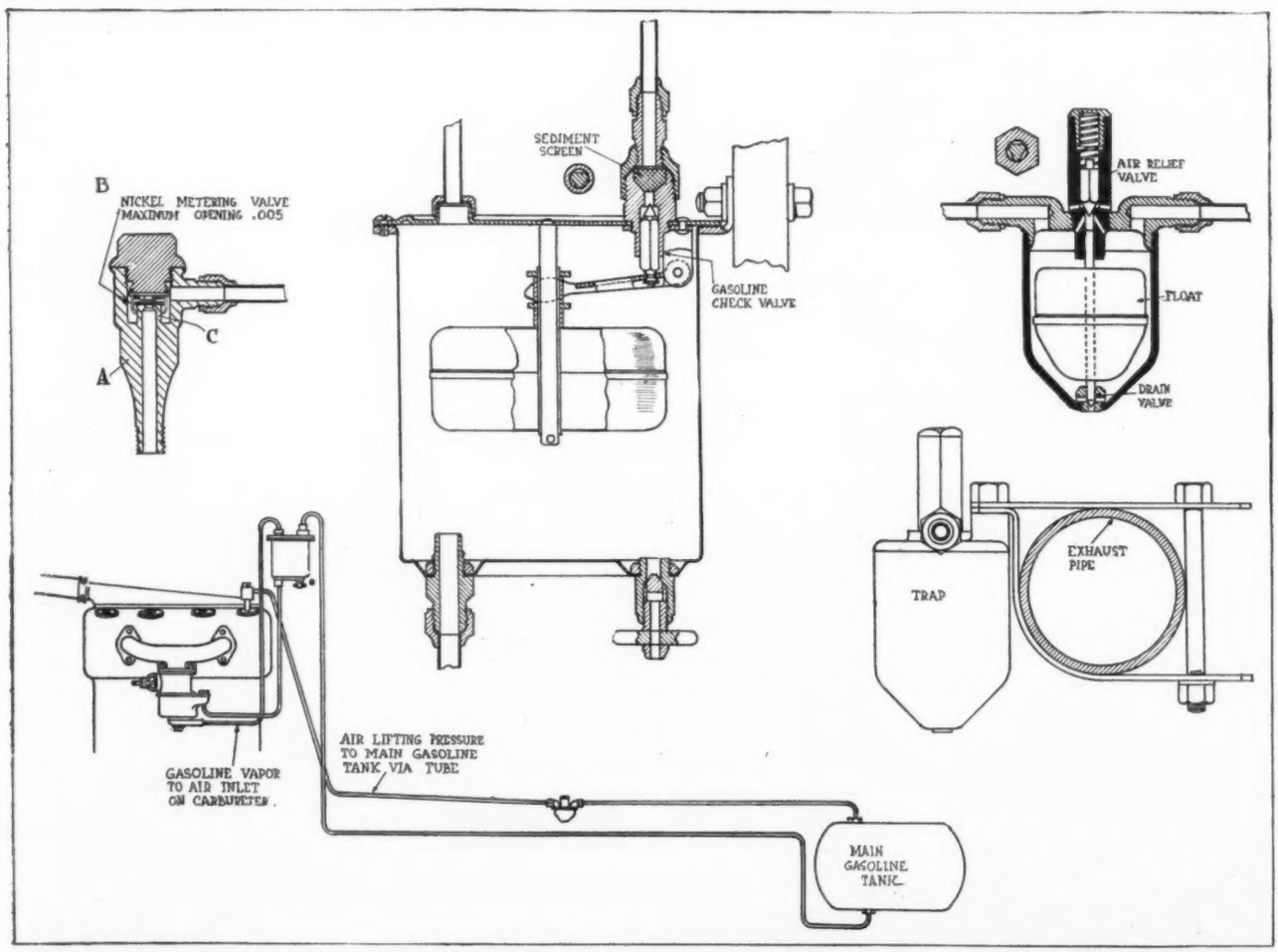
Automatic Discharge Water Trap Incorporated in Pressure Line—Design Simplified in Many Details

IT will be remembered that the Church fuel feed system, announced during the Fall of 1916, takes pressure direct from one of the combustion chambers of the engine and uses it to lift gasoline from a rear tank to a supplementary tank, whence the feed to the carbureter is by gravity. Since its first introduction the system has been improved in detail and now includes some very ingenious devices, of which the automatic discharge water trap is foremost.

As part of the products of combustion is water, it is necessary to catch this before it can reach the main fuel tank. Therefore a trap is placed in the pressure line, the details of this being fully made clear in the sectional drawing. However, a trap of this sort needs to be emptied when a sufficient amount of water has collected, and since the driver might neglect to perform this operation it is made automatic in the new Church system. The trap chamber contains a float which controls a needle valve at the bottom and, when a sufficient amount of water has collected, the float lifts the valve, allowing the water to escape.

Here occurs another ingenious idea. The water collecting in cold weather is liable to freeze, and if it does so the float cannot act, and the whole trap may get filled with ice. To counteract this the trap is provided with clips that attach it to the exhaust pipe, where it is kept well above freezing temperature. The pressure release valve is combined with the trap assembly, and the warmth is beneficial to this also, as it prevents the accumulation of gummy oil as might happen with an over lubricated engine. In the section of the trap the water valve is seen at the bottom and the pressure release valve at the top of the chamber.

The supplementary fuel tank which supplies the carbureter by gravity, is also shown in the cut. Fuel enters at the top and the supply is cut off when the float rises enough to close the valve in the cover. Immediately back of this valve there is a screen for removing impurities from the gasoline. To allow the gravity feed it is necessary that there be an opening at the top of the tank to admit atmospheric pressure, and through this opening a certain amount of gasoline vapor might escape, thus causing waste. To prevent this the top opening is connected to a copper pipe that is carried down



Details of the improved Church gasoline feed system, showing use of automatic discharge water trap, as well as layout of the system in connection with an engine, details of water trap, section through fuel tank and also through metering valve

to the air intake side of the carbureter; causing any escaping vapor driven off by the heat within the hood of the car to pass in with the entering air and so be consumed within the cylinders together with the rest of the explosive mixture.

The pressure valve that is attached to the engine possesses a great simplicity. The body A is bored out at the top so that there is left an upstanding piece C, like the cut off end of a tube. On top of this rests a nickel-steel disk B kept in place by the little cage that is shown surrounding it. With the explosion and the compression strokes the valve lifts a maximum distance of 0.005 in., allowing some gas to pass into the pressure line, the release valve on the side of the exhaust pipe being set to blow off at about 1½ lb. per sq. in.

The feed is, of course, not affected by throttle position. As long as the engine is running there is a more than adequate supply of pressure, and the gravity tank contains more than sufficient for starting up. It is essentially an exhaust pressure system with all the drawbacks removed. It is simpler than the air pressure system that calls for a pump on the engine, and it is claimed that it can be made smaller and lighter than an equally efficient system that depends upon depression in the inlet pipe for power to lift the fuel.

Conveyor Cuts Overland Export Expense

THE Willys-Overland Co., Toledo, has installed a number of machines designed to facilitate export shipment and to increase production. Export shipments, formerly requiring a number of workers who carried the boxed automobiles from the shipping room to the waiting freight cars, are now performed by means of a large electric crane.

The crane runs through an overhead groove conveyor, approximately 500 yd. long and constructed in a circle. The operator sits in a small box-like compartment, somewhat similar to the cab of a locomotive, and is situated directly below the steel frame of the crane. After the automobile has been disassembled and packed in a large wooden box, steel chains on the crane mechanically grasp it and the engineer, by means of his motor, carries the box to the freight car outside of the building, deposits it and returns on the circular conveyor to the shipping room. The appliance has effected an important saving of time and labor, besides insuring more careful handling with a consequent decrease of damage to the box and automobile.

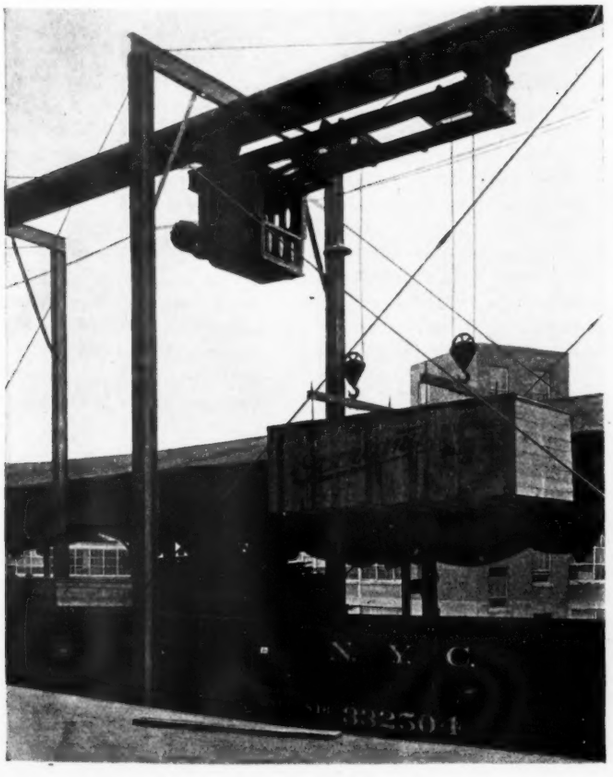
The company has also installed in its factory three Gisholt automatic machines, which eliminate considerable labor. The machines are watched by one worker, whose sole duty includes the setting of raw flywheel castings and the removal of them after they are finished. Each machine performs twenty-six operations in 14 min. by means of a number of tools, which comprise knives, polishers, reamers and bores. When the flywheel is set for the automatic operations it weighs 100 lb. When it is removed the weight is 76 lb., 24 lb. having been eliminated by the work performed on it.

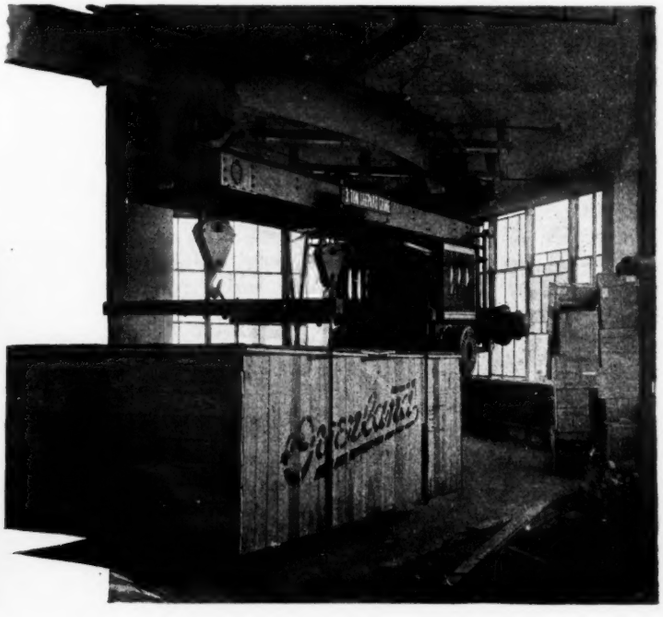
Another new machine, used for drilling holes in raw crankcase castings, drills eighty-one holes in 10 sec. This machine covers 19 sq. ft. of floor space, with 7 sq. ft. of working space. The worker places the raw casting on a roller wheel conveyor, wheels it to the first part of the huge machine, and turns the casting over automatically into the machine so that it is ready for the drilling.

Cementing Tires Before Building

IN cementing tires before building, in vulcanization work, three coats should be applied. The first coat should be thin because it is a priming coat, just as in painting a building. The priming coat must get into the pores to form a foundation for the succeeding coats, and a thin application serves this purpose best.

The first coat should be brushed in thoroughly and allowed thirty minutes to dry. The second coat should be 50 per cent heavier and given the same time to dry. The last coat is a light one and should dry from 3 to 5 hr., according to atmospheric conditions.—*Goodyear Tire News.*





Below the new electric crane at the plant of the Willys-Overland Co., Toledo, is illustrated picking up a box containing an automobile packed for export shipment preparatory to moving it to the waiting freight car

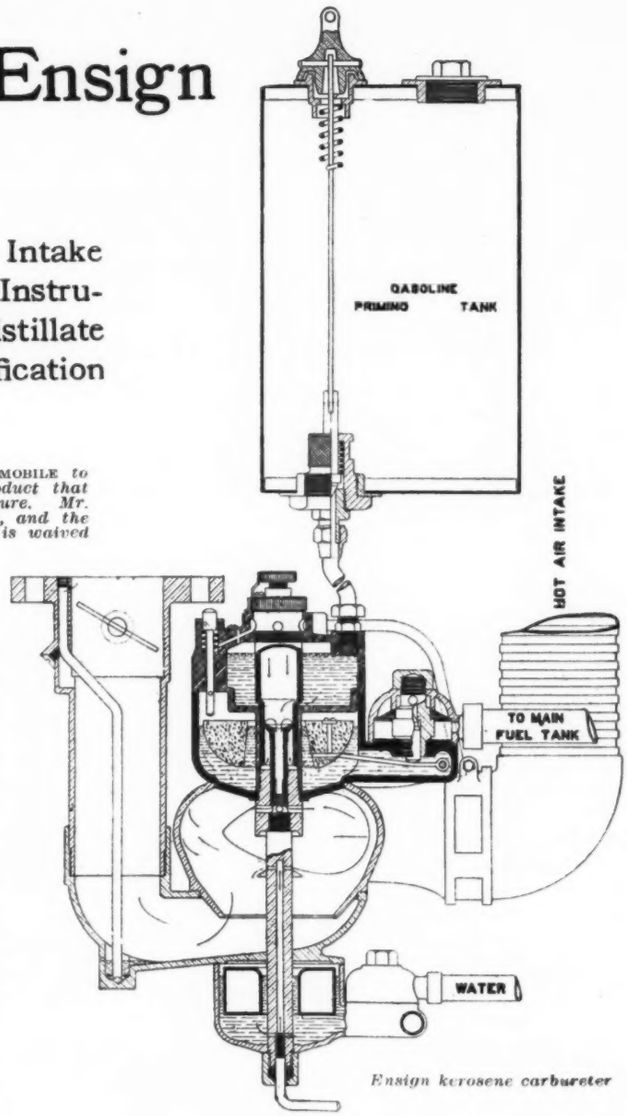
At the left the crane is shown swinging the box containing the automobile into the freight car for the first stage of its long journey to a foreign land

Low Velocity in Ensign Carbureter

Dimensions of Smallest Part of Intake Equal to Manifold Size—Same Instrument Claimed to Use Gasoline Distillate or Kerosene with Small Modification

By A. W. Ensign

Editor's Note—It is not the policy of THE AUTOMOBILE *to accept from manufacturers descriptions of their product that might be considered to be of an advertising nature. Mr. Ensign's letter, however, is so especially interesting, and the nature of his carbureter is unique so that our rule is waived for this instance.*



Ensign kerosene carbureter

REFERRING to the very interesting article on carbureters appearing in THE AUTOMOBILE for Dec. 15, I wish to call attention to the fact that it is difficult to place the Ensign carbureter in any of the divisions used in those articles in classifying carbureters.

In describing the method by which the different classifications were arrived at these statements are used: "At the same time this main jet or primary device which supplies the engine at low speeds must play its part in wider throttle openings. The ways in which this compensation is made may be classified as follows: Side Valve, Metering Pin, Compensating Jet, Expanding and Miscellaneous Types." The writer then classes the Ensign with the air-valve type.

The vortical action of the mixing chamber of the Ensign carbureter is depended upon to create the right proportion of fuel and air at all speeds and is only slightly modified for the extreme low idling speeds. This is accomplished by an unbalanced butterfly valve free to swing on a shaft passing horizontally through the axis of the air inlet horn.

The butterfly is a flat circular plate fitting loosely in a finished cylinder with enough of the top cut away parallel to the horizontal axis around which it swings to give the desired result. The diameter of this air inlet horn is enlarged where the butterfly is suspended so that the velocity affecting this butterfly is one-half that in the intake manifold. The butterfly is so constructed that at engine speeds corresponding to car speeds of from 7 to 12 m.p.h. it lies horizontal, so that at all normal working speeds it cuts the air at one-half manifold velocity as a knife edge. In fact, remove it wholly from its position at the point where it is most effective and it does not change the vacuum in the mixing chamber more than that due to a water column ¼ in. high. This device for effecting the mixture at extreme low idling speeds plays no part in forming the mixture at any working speed. It can be, and is, left out on a large percentage of engines and is never used with distillate or kerosene where heat is required. No heat is ever used in connection with this carbureter for any grade of gasoline so far encountered. Therefore, this carbureter cannot be classed with the air valve type, because the air valves in all others so classified are a factor in proportioning the mixture at all speeds.

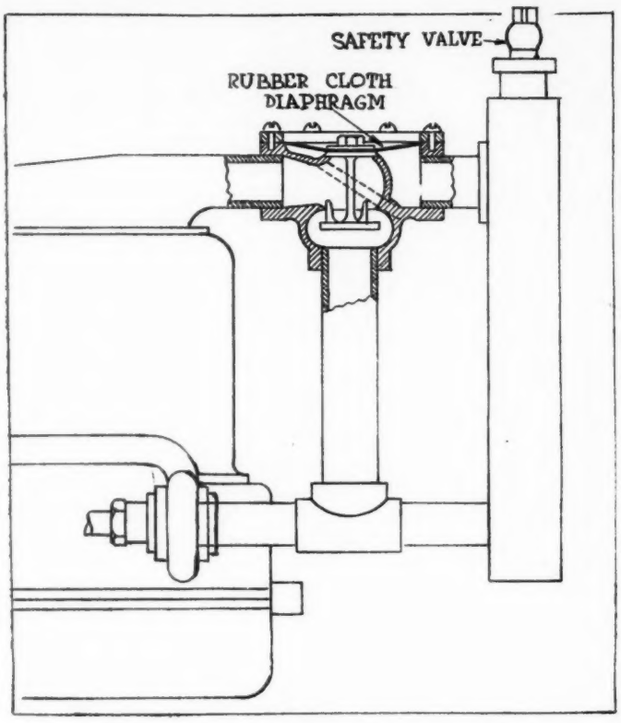
No Jets Used

There are no jets from the float bowl. Suction, produced at the center of the mixing chamber by centrifugal force and acting on the whirling air body, is communicated to a suction chamber within the float bowl through a stand pipe or suction tube projecting above the fuel level in this suction chamber. A fuel orifice in the wall of the suction chamber allows fuel under the suction therein to enter the chamber and thus overflow down through this stand pipe to the mixing chamber, where it is acted upon by the whirling mass of air.

The fuel orifice is submerged, consisting of a hole about 1/16 in. in diameter through a wall less than 1/16 in. thick. This allows instant acceleration and prevents clogging from fine particles floating in the fuel or material in solution being left in the opening on account of partial vaporization as in a nozzle. This orifice is adjusted by cutting off one side of the hole as by means of a shutter, leaving a relatively large free opening.

Only Two Adjustments

The suction on the orifice is also adjusted by the control of a small valve lifted by the partial vacuum in the suction chamber. This valve allows a slight leak of air into the suction chamber immediately above idling speed. The amount of air thus admitted is infinitesimal and is proportional to the main air at all speeds. Both these adjustments are mounted on the same piece on top of the float bowl, thus there are only two milled nuts close together for the whole range of adjustments. In the standard carbureter, the *smallest* opening in the air or mixture path through the carbureter is equal in area to the engine manifold and therefore gives the same



Radiator outlet control arranged to maintain jacket temperature above 212 F.

velocity. The only element depended upon for proportioning the mixture and reducing it to an atomized vaporized or fogged condition is the shape of the mixing chamber.

The pressure drop in the center of the vortex mixing chamber is near enough proportional to the square of the rim velocity to give the correct mixture at all speeds, and this drop of pressure at average and high speeds, combined with the whirling action, breaks up the fuel to a degree of extreme fineness. This is better understood when attention is called to the fact that the body of air in the mixing chamber rotates at higher than 10,000 r.p.m. at full load with manifold velocity at 150 ft. per second. At starting and idling and slow speeds, the whirling air only performs the function of a centrifugal pump impeller pumping into the mixing chamber the correct amount of fuel which falls to the sump at the bottom where it is drawn by the vacuum above the throttle through the by pass tube along with some air; entering the manifold as a vapor, or as finely atomized spray in the case of distillate or kerosene.

Easy Start from Cold

This design of carbureter makes it possible to start a cold engine and to get nearly full power immediately because, when the throttle is opened, the violent action in the mixing chamber provides a fog from the fuel and air that is not dependent on heat or a vacuum. It idles slowly with a cool engine without a separate jet from the float bowl because the fuel does not have to be lifted through a mixing chamber at low velocity from a fuel jet to the throttle valve, but drops by gravity to the bottom and is therefrom lifted by the vacuum above the throttle. Hence, none of the choking devices are necessary and are not in the way of a free flow of air or mixture at high speed and power.

To adapt this carbureter to the use of kerosene or other heavy distillates, a chamber for receiving a definite limited charge of gasoline is substituted for the float bowl cover. The gasoline, immediately on charging this chamber, begins to flow by gravity to the sump at the bottom, and the first four or five explosions of the engine are on gasoline. Then, until the chamber is exhausted, a mixture of 1 to 6 of gasoline and kerosene results. In summer, one charge is enough; in winter, two or three may be necessary before the engine will be warm enough to operate on kerosene alone.

The writer's experience in operating with kerosene has brought out some very definite points that are essential to success. Owing to the viscosity of kerosene when cold, it is not easily broken up without heated air; 185 deg. Fahr. has been found sufficient for all purposes, but this temperature must be sustained beyond the carbureter, hence intake manifolds must be heated to at least that temperature. In short connections to cast-in manifolds water jackets may suffice; but for exposed, large intake manifolds exhaust gases must be used and means for controlling the temperature provided to suit weather conditions. If heated to more than 200 deg. Fahr., loss of power will occur. Most important of all, the cylinder wall temperature must be sustained above 185 deg. Fahr., preferably about 212 deg. Fahr. at sea level.

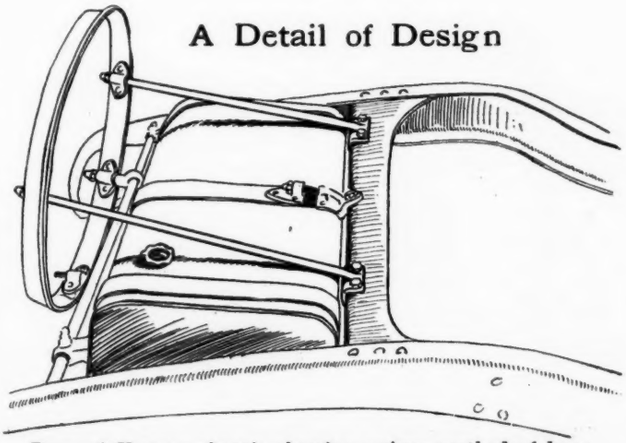
The most effective method of doing this is to close the circulating system tight against pressure of 1 lb. per square inch, provide a by-pass from top of engine block to pump suction, cutting out the radiator; control this by-pass by a valve operated by a diaphragm with one side exposed to the air and the other to the vapor pressure in the closed circulating system.

In starting a cold engine, water circulates in the water jackets only, and when water begins to arrive at the top at the boiling point before bubbles of steam can form in the jacket space the pressure of water vapor will lift the valve and cause just enough water to pass to the radiator to hold it constant to within one degree of the desired temperature. If the water stands above the diaphragm a few inches in the radiator, and the valve is then closed by spring tension, regulation of the spring pressure will allow temperature control at some point lower than that due to the boiling point at the prevailing atmospheric pressure or can be set at boiling point or slightly above. A small quantity of a fluid of a lower boiling point added to the water would again give a new temperature.

Water Used with Kerosene

A water float bowl is provided on the carbureter for kerosene to control pre-ignition. It is placed below the carbureter with a needle valve adjustment and is so arranged it cannot come into action in starting or idling but does come into action at about one-third load. With this carbureter properly installed, any fuel distilled from petroleum of 40 gravity or over can be used. To use gasoline it is only necessary to remove the hot air connection and exhaust from the intake manifold and put gasoline in the tank, when generally no readjustment is required.

A Detail of Design



Rear of Haynes chassis showing unique method of bracing spare tire carrier. This gives a light yet rigid construction

Easy Ability Testing

Simple Methods Show Car Condition or Permit Ready Comparison—Determining Grade Accurately By Eye —Required Tools Speedometer and Stop Watch Only

By Charles E. Manierre

UNTIL quite recently there appeared to be no inexpensive method by which the ability of the engine and condition of the car could be tested with any exactness except by the manufacturer. The experienced driver could tell in a general way whether the car was up to its usual capacity or not, but the the most that he could say was that it was either running very well or that it needed attention. Fortunately it now requires little in the way of scientific knowledge or of scientific instruments to enable one to make a fairly accurate test of the ability of his car.

Basis Is 10 m.p.h. Variation

This article is written chiefly for the benefit of those who have at least a slight understanding of the meaning of a "rolling resistance curve," (which throughout this article will be deemed to include wind resistance,) and of a "torque curve" on high gear, although a careful reading of the article will no doubt furnish this information to an attentive reader.

The tests proposed are based upon the suggestion of Mr. C. P. Grimes in the May, 1916, issue of the S. A. E. *Bulletin*, at page 286, in which the time necessary to increase the speed or decrease the speed of the car by 10 m.p.h. becomes the basis for a calculation of the resistance overcome by the car, or which the car could overcome at the mean speed, *i.e.*, a speed 5 miles greater per hour than the original speed, if the car is accelerated or 5 miles less than the original speed if the car is slowed down. The assumption is that in each case there is either a steady decrease in speed or a steady increase in speed through the number of seconds which elapse, in which the car speed is reduced or increased by 10 m.p.h. The assumption is not quite exact. It is equivalent to assuming that the torque and rolling resistance curves between the speeds involved are straight lines. The error results in only a very slight diminution of the torque curve and a slight exaggeration of the rolling resistance curve.

Table 1 is based on the fact that a car running one mile per hour passes over a distance of 1.466⅔ ft. per second. At 10 m.p.h. it passes over 14.66⅔ ft. per second.

At whatever speed the car may be running, if it increases or decreases in speed by 10 m.p.h. in any given number of seconds, the number of seconds so required divided into 14.666⅔ gives the rate of such change, in feet per second, per second.

Mr. Grimes used a stop watch, and this would seem to be desirable, particularly where the car speed is increased and the observation takes but a few seconds. Interesting results can be obtained, however, by merely estimating the seconds by count. This of course would require some practice. For taking account of the grades of the roads on which experiment is made, an inexpensive, home-made instrument is hereinafter suggested, which would require practice also in pacing distances. The method does not involve any calculations, as

TABLE I.

Secs.	Ft. per Sec.	Resistance	Grade
1	14.66	916.5 lbs.	45.8%
1½	9.78	611 lbs.	30.5%
2	7.33	458 lbs.	22.9%
2½	5.86	366.6 lbs.	18.3%
3	4.89	306 lbs.	15.3%
3½	4.19	268 lbs.	13.4%
4	3.67	229 lbs.	11.45%
4½	3.26	203.7 lbs.	10.2%
5	2.93	183.3 lbs.	9.1%
5½	2.66	166.3 lbs.	8.3%
6	2.44	152.7 lbs.	7.6%
6½	2.26	141.3 lbs.	7%
7	2.10	131 lbs.	6.5%
7½	1.96	122 lbs.	6.1%
8	1.83	114.5 lbs.	5.7%
8½	1.73	107.8 lbs.	5.4%
9	1.63	102 lbs.	5.1%
9½	1.54	96.2 lbs.	4.8%
10	1.46	91.5 lbs.	4.58%
10½	1.40	87.5 lbs.	4.38%
11	1.33	83.6 lbs.	4.18%
11½	1.275	79.7 lbs.	3.98%
12	1.22	76.3 lbs.	3.8%
12½	1.173	73 3 lbs.	3.66%
13	1.13	70.5 lbs.	3.52%
13½	1.090	67.9 lbs.	3.39%
14	1.05	65.5 lbs.	3.26%
14½	1.011	63.1 lbs.	3.15%
15	0.97	61.1 lbs.	3 05%
15½	0.946	59.1 lbs.	2.95%
16	.91	57.25 lbs.	2.86%
16½	.88	55.5 lbs.	2.78%
17	.86	54 lbs.	2.7%
17½	.84	52.5 lbs.	2.62%
18	.82	51 lbs.	2.54%
18½	.80	49.6 lbs.	2.46%
19	.77	48.2 lbs.	2.40%
19½	.75	46.83 lbs.	2.34%
20	.73	45.7 lbs.	2 30%
40	.36	22.8 lbs.	1.15%

The first column of this table indicates the number of seconds required to increase or reduce speed by ten m.p.h. Opposite this is the rate of acceleration or retardation in ft. per sec., per sec., next the corresponding resistance in pounds per ton of 2000 lb., and finally the corresponding grade per cent.

SUPPLEMENTAL TABLE

Giving seconds and intervals of one-fifth of a second between four seconds and twelve seconds.

Secs.	Ft. per Sec.	Resistance	Grade
4	3.67	229.4 lbs.	11.45%
4.2	3.49	218 lbs.	10.9%
4.4	3.33	208 lbs.	10.4%
4.6	3.15	197 lbs.	9.8%
4.8	3.05	190 lbs.	9.5%
5	2.93	183 lbs.	9.1%
5.2	2.83	177 lbs.	8.8%
5.4	2.72	170 lbs.	8.5%
5.6	2.62	164 lbs.	8.2%
5.8	2.53	158 lbs.	7.9%
6	2.44	153 lbs.	7.6%
6.2	2.36	148 lbs.	7.4%
6.4	2.29	143 lbs.	7.1%
6.6	2.22	139 lbs.	6.9%
6.8	2.15	135 lbs.	6.7%
7	2.095	131 lbs.	6.5%
7.2	2.03	127 lbs.	6.3%
7.4	1.98	124 lbs.	6.2%
7.6	1.93	121 lbs.	6.0%
7.8	1.88	118 lbs.	5.9%
8	1.83	115 lbs.	5.7%
8.2	1.79	112 lbs.	5.6%
8.4	1.75	109 lbs.	5.4%
8.6	1.71	106 lbs.	5.3%
8.8	1.67	104 lbs.	5.2%
9	1.63	101.5 lbs.	5.0%
9.2	1.59	99 lbs.	4.9%
9.4	1.56	97.5 lbs.	4.8%
9.6	1.53	95 lbs.	4.7%
9.8	1.50	93 lbs.	4.6%
10	1.4666	91.5 lbs.	4.55%
10.2	1.44	90 lbs.	4.5%
10.4	1.41	88 lbs.	4.4%
10.6	1.38	86.5 lbs.	4.3%
10.8	1.36	85 lbs.	4.2%
11	1.333	83 lbs.	4.15%
11.2	1.31	82 lbs.	4.1%
11.4	1.29	80.5 lbs.	4%
11.6	1.26	79.5 lbs.	4%
11.8	1.24	78 lbs.	3.9%
12	1.222	76 lbs.	3.8%

the tables published herewith supply the information directly.

The rolling resistance curve, so far as it is necessary to be understood for the present purpose, merely indicates the number of pounds resistance per ton weight of the car overcome by the forward motion of the car on a level, straight macadam road. The ton is taken at 2000 lb., and the weight of the car includes its full passenger capacity, together with water, gas, oil, tools, etc. If the car were pulled forward by a spring balance and its weight exactly one ton, including its passengers, the indicator of the balance would show this resistance overcome in pounds. This resistance increases rapidly with increasing speed. Plotting the resistance at the several speeds on a suitable diagram, showing miles per hour and pounds per ton weight of the car, results in the above mentioned rolling resistance curve, which is becoming common enough in automobile literature.

Of course it is desirable to have this curve as low as possible. The less the resistance the greater is the saving in gasoline, and the greater also is the ability of the car both in speed and in hill climbing. When this curve is known as to any particular car, an increase at once indicates some difficulty either with the engine or with other parts of the car.

The torque curve shows so much of the power in pounds per ton of the engine at each speed as is delivered to the rear wheels. Part of this power is absorbed in the rolling resistance. The remainder is available for the climbing of hills, driving through gravel or mud and for any other purposes where extra power is called for, without diminution of speed. If the rolling resistance curve of a particular car remains the same but the torque curve is lowered, it indicates probably some difficulty in the engine, usually the effects of carbon in the cylinders. As it requires exactly 20 lb. of energy per ton to overcome each 1 per cent of grade, a glance at the diagram for a car shows at once for any given speed, the difference between the total pounds of torque and those absorbed by rolling resistance, and this divided by twenty gives the exact grade the car can ascend at that speed.

From what has been said, it is evident that there are two questions which may be asked respecting the motion and power of a car at any speed on a level, good road. The first is, how much resistance it is overcoming, and the second, how much more resistance can it overcome if necessary? The answer to the first question is the rolling resistance at the given speed, and that answer, together with the additional resistance, found in answer to the second question, indicate the torque power at the given speed.

Start Test at 10 m.p.h.

Assuming a level, good road, and a suitably loaded car, *i.e.*, a car with its full complement of passengers, etc., the first of these two questions is answered by bringing the car up to a given speed, say 10 m.p.h., declutching and noting the number of seconds required to coast to a standstill. The mean speed will have been, of course, 5 m.p.h. Referring to Table I and assuming that it has required 20 sec., we find that the mean resistance, *i.e.*, the resistance at 5 m.p.h. is approximately 46 lb. If the car is then brought up to a speed of 15 m.p.h. and by declutching is allowed to drop to 5 miles, the average speed is 10 miles. If that has taken 18 sec., the table indicates a resistance of 51 lb. Thus, by starting each initial speed 5 miles greater for each successive test, we secure the resistance for a succession of mean speeds, each 5 miles less than the initial speed, having in each case noted the number of seconds which are required to reduce the speed by 10 m.p.h. If desired, the results may be plotted on a diagram and the resistance curve drawn. For practical use, however, a memorandum of the seconds required at the several speeds would be all that would be needed for reference. Even the table would not have to be consulted in a later test of the condition of the car. All that would be needed would be a memorandum of the seconds noted in the first test.

Somewhat similarly, the second part of the test consists in accelerating the car speed, first from 5 to 15 m.p.h., noting the number of seconds required and finding from the table the number of pounds of "resistance per ton overcome," as being the *surplus* energy at the mean speed of 10 m.p.h. Assuming for the sake of illustration that this was 5 sec., reference to the table would show that the surplus energy of the car at the speed of 10 m.p.h. was 183 lb. per ton weight of the car, and referring again to the result obtained by the previous test at a mean speed of 10 m.p.h., which we may assume to have been 18 sec., and the corresponding number of pounds 51, the total energy of the car would consist of 183 + 51, *i.e.*, 234 lb. available at the rear wheels. Similarly, successive tests begun at 10, 15, 20, 25 and 30 m.p.h., accelerating to an additional 10 m.p.h. in each case, will give the surplus power of the engine at each mean speed, five miles greater than the initial speed. For each speed, adding the resistance found in the table and the resistance already found to be overcome in the first series of tests, will give the total power of the engine for each speed and permit the plotting of the torque curve.

Two Illustrations

As in the case of the first series of tests, for subsequent tests of the car, only the number of seconds elapsing at each speed will be needed to show the condition of the car and engine. As an illustration, the two tests might result as follows:

ROLLING RESISTANCE

Seconds	M.P.H.	Mean Speed	Resistance Lbs.
15	10 to 0	5	61
13	15 to 5	10	70
11½	20 to 10	15	80
11	25 to 15	20	84
10	30 to 20	25	92
8	35 to 25	30	115
7¼	40 to 30	35	125

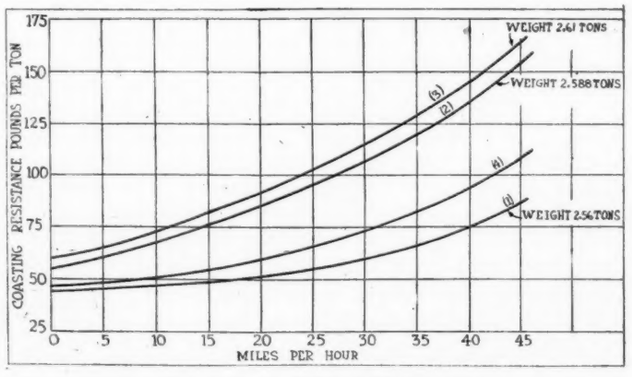
ADDITIONAL ABILITY

Seconds	M.P.H.	Mean Speed	Additional Ability, Lbs.
6	5 to 15	10	153
5¾	10 to 20	15	160
6	15 to 25	20	153
6½	20 to 30	25	142
7½	25 to 35	30	122
9	30 to 40	35	102

TOTAL ABILITY FOR TORQUE CURVE

M.P.H	Rolling Resistance, Lbs.	Additional Ability, Lbs.	Total Lbs.
10	70	153	223
15	80	160	240
20	84	153	237
25	92	142	234
30	115	122	237
35	125	102	227

Referring to the diagram herewith, reprinted from an article by Prof. W. G. Marshall in THE AUTOMOBILE of 24th April, 1913, page 889, Fig. 3, the test here proposed for finding rolling resistance would show the seconds and corresponding resistance about as follows, for the theoretical curve, which on the diagram is numbered (4).



Professor Marshall's original curve

Seconds	Reduction in Speed M.P.H.	Mean Speed M.P.H.	Resistance Lbs.
19	10 to 0	5	48
18	15 to 5	10	51
16½	20 to 10	15	56
15	25 to 15	20	61
13½	30 to 20	25	68
12½	35 to 25	30	74
10½	40 to 30	35	87

On the same diagram are the rolling resistance curves of three cars, one of which is below even the theoretical curve, which, by the way, is empirical and therefore one which will admit of such a possibility. For this last mentioned curve, No. 1, the sequence of observed seconds, as derived from the table, by looking first for the number of pounds of resistance at each speed, would be 20, 19½, 18½, 17½, 16½, 14½ and 13½. The other two car curves show unusual resistance, and in the case of one of them it was stated that the brake band was found to be dragging. The observed sequence of seconds for these curves would be for No. 2, 15, 13½, 12, 11, 9½, 8½, 7½, and for No. 3, 13½, 12½, 11, 10, 9, 8, 7.

Having once tested a car through a series of speeds, both accelerating and retarding, one would have at hand the number of seconds found at the several speeds, both for accelerating and retarding the car and could then, at any time, when there happened to be a full complement of passengers, accelerate or declutch and in a few moments be able to compare the present car condition with its former performances.

It should be borne in mind that while these tests reveal present engine ability and condition of the car, they do not give any clue to workmanship nor the quality of material used in the car. Time alone will show this. It should also be remembered that while a new car might be subjected to the rolling resistance test through moderate speeds, it ought not to be subjected to the acceleration test until it has run for a thousand miles or more. After that it should show increasing power with additional use of the engine.

Can Test on Grade

It has been assumed that a level road is to be utilized for these tests, but it is, as to some of the tests at least, possible to utilize a road with a slight grade of 2 or 3 per cent. In such case the tests must be repeated in opposite directions in each case and the results to be taken are the mean values of the pounds of resistance and not the mean of the number of elapsed seconds. If an attempt is made to utilize the mean of the seconds an error is introduced. As to the matter of speed watches, it may be said that they can be purchased for a minimum of $4. But a more satisfactory watch of Swiss make, including the regular hour and minute hands, can be had for $18.75. The seconds are divided into fifths and the subdivisions are outside the line of the even seconds and therefore much more easily read. It may be permitted to mention that F. William Barthman, corner of Broadway and Maiden Lane, New York, is one from whom such a watch could be purchased.

It is worth while to practise with the aid of such a watch the counting of seconds, accompanied by some motion or pressure of the finger or foot. With practice, seconds may be counted with considerable accuracy, so that up to perhaps 15 sec. it might be even possible to note a fraction of half a second by such an estimate, the watch in that case being an excellent check on the accuracy of the count. Another way of counting when the number of seconds to elapse is less than 10, is by counting as rapidly as possible, each unit of the count being a fifth of a second. This also is a matter which requires practice. Astronomers, aided by the ticking of a seconds pendulum, ordinarily expect to estimate to one-tenth of a second, but of course they start from the last even second as given by the tick of the clock.

Needle Speedometer Best

In utilizing the method above indicated, a speedometer with an indicator needle is superior to those which merely display a number, as a mere glance is sufficient to read them. In fact, the indicator needle is for all purposes safer, for the eye can take note of the angle of the needle quicker than it can read figures displayed in an opening. The lag of the instrument and its error, particularly at low speed, will have to be estimated as well as possible. This can be determined by taking time over a measured course.

Several repetitions of the same test will give a clue to the probable accuracy of the observer. If his results vary widely the value of his readings will be greatly diminished. If they are nearly alike they will have a higher value, but there will still remain the question of the personal equation, which will have to be looked into as well as possible. One driver will always be a little short in his estimate and another a little over. But as to this it may be said that the error being peculiar to the person, it is likely to be repeated in successive experiments, so will not really interfere with the comparisons which the same driver may wish to make with later figures of his own obtaining. Of course, the personal equation would enter also into the starting and stopping of the watch as well as in the estimating of the time.

Grade Sometimes Advantage

If the per cent grade is known, there is sometimes an advantage in utilizing it in preference to a horizontal road. On a 3 per cent grade, making the tests down the grade, 60 lb., due to the grade, is deducted from the actual rolling resistance and instead of, for example, 5½ sec. showing a true resistance of 166.3 lb., the time on the grade will approximate 8½ sec., indicating about 107.8 lb., to which is afterward added the 60 lb. of grade resistance, to obtain the result with an accuracy within 2 lb. The chief advantage of this is that it spreads out the time of the observation and that an error of ½ sec. at 8½ sec. is only 5 lb., whereas at 5½ sec. it amounts to 20 lb.

There are, of course, very definite limits, outside of which use cannot be made of even a 3 per cent grade. For example, if the rolling resistance at 15 m.p.h. is in fact 50 lb., a car declutched on a 3 per cent grade would run on indefinitely, the acceleration due to grade being in excess of the rolling resistance of the car.

The grade per cent can sometimes be found by running the car up the grade and afterward down the grade. If the coasting resistance at a given mean speed up the grade is found to be, for example, 150 lb., and down the grade 70 lb., the mean of these, or the true rolling resistance is 110 lb., and the difference between this and each of the readings obtained is 40 lb., which divided by 20 (20 lb. to each 1 per cent of grade) gives 2 per cent as the actual grade.

The grade per cent being known, if the run is made up the grade and the 10 m.p.h. drop in speed on declutching takes 9 sec., corresponding to 102 lb. resistance, 60 lb. is to be deducted for grade, assuming it to be 3 per cent. The rolling resistance is therefore only 42 lb. for the mean speed of the test. If on the other hand the same test is run down the grade and results in 9 sec., the corresponding resistance is 102 lb., to which the grade resistance of 60 lb. is to be added and the actual rolling resistance is 162 lb. Briefly it may be said that the length of level road necessary for these tests, exclusive of the distance required to get up speed, is approximately only 100 yd., whether the tests are at high speeds or at low speeds.

For rolling resistances between the mean speeds of 10 and 35 m.p.h., the resistance should vary between 50 and 125 lb., according to the speed, and the number of seconds required should be between 7 and 20, neither more nor less except on grade. For acceleration, the equivalent pounds of resistance overcome should vary between 75 and 200 lb., and the seconds required by the test would be between 4½ and 13. It will be obviously advantageous to run these latter tests up a definitely known grade of 2 or 3 per cent, thus increasing

the number of seconds elapsing. If time is estimated without a watch, the results will probably be most correct where the time varies between 8 and 15 sec., but if made with a stop watch, the more accurate results will be where the time varies between 10 and 20 sec. A 3 per cent up grade will reduce a 20-sec. test to about 9 sec., while a 3 per cent down grade will bring a 6-sec. test up to 13 sec.

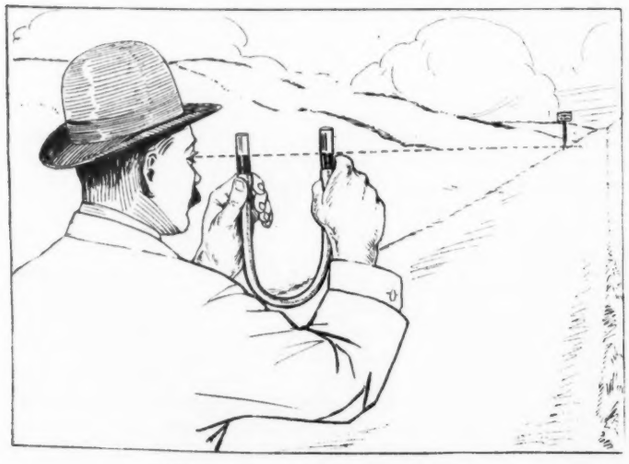
The maximum speed which a car can maintain ascending a steep grade of which the per cent is known, gives an accurate gage of the accelerative power, and on the other hand, the maximum coasting speed on a long, slight grade gives an equally accurate gage of the rolling resistance at that speed. The method above indicated for ascertaining the grade per cent is, of course, applicable only to very slight grades. For steeper grades other means have to be employed.

Formerly there were for sale several kinds of grade measures intended to be attached to the car. They seem not to have been very popular and the only one now occasionally to be found is a glass tube, metal inclosed, containing a shot moved slowly in a liquid against a paper scale. The accelerometer will also indicate grade, if properly leveled, the car either being stopped or proceeding at an even rate of speed. Makers of surveying instruments also carry in stock several kinds of clinometers for measuring the slope of masonry, etc. These could be temporarily applied to any horizontal part of a car standing on a slope. These instruments, however, have too great a range of grades and the part of the scale useful for automobiles is too minute for practical use, even with the verniers which are a part of some of them. The wheelbase of the car is also not sufficiently long to indicate very accurately the slope of the hill.

Fortunately there is a ready way of obtaining the grade per cent with sufficient accuracy and with little trouble or expense. The height of the observer's eye, as he stands erect, given in feet and decimal fractions of a foot, furnishes the perpendicular. The number of paces up the hill required to reach the point where the level of the eye intersects the roadway supplies the only other information necessary. Surveyors adopt as standard a pace of 2½ ft. This is distinctly shorter than the usual step, and thus requires some practice and attention. A New York City avenue block is 260 ft., including the cross street, *i.e.*, from the north curb of one street to the north curb of the next, and should be covered in exactly 104 paces. Wherever the pacing is practised the distance should be measured and the practice continued until the exact number of steps can be regularly taken.

How to Gage Grade

The mental estimate of the point where the eye level intersects the roadway will be found to be too far up the hill. A hand level can be improvised as described below, or can be purchased. On the market there is a 5-in. level consisting of a sighting tube and the level bubble which is reflected down into the line of sight by a prism. This is manufactured by Keuffel & Esser, a New York corporation making surveying instruments and having branches in other cities, the price being $4.50. W. & L. E. Gurley of Troy, N. Y., make a similar but slightly larger level at $8.



Apparatus for grade determination

The home-made level consists of a foot length of rubber tubing with a short length of glass tubing inserted at each end of the rubber tubing, the whole being filled with water. For sighting the two glass ends are held perpendicular, the water level in each being, of course, the same, and the two ends being held 6 or 7 in. apart and in line with the eye and the road. As the water level always remains the same the whole instrument will have to be elevated or lowered in order to get the water surfaces in line with the eye. The point where the water surfaces intersect the road is then to be noted and the distance paced.

Sighting Requires Practice

For one accustomed to rifle shooting, the sighting is at first a little difficult, as the attempt to compel one water level to come into line with the other will, of course, end in failure, the fact that they are not in line with each other merely indicating that the whole instrument is either too high or too low. This instrument is accurate well within the needs of the observer. Any drug store can furnish the materials. An ordinary 10-in. glass feeding tube can be had for 5 cents. This is nicked in the middle with a file and broken into two lengths. By heating the ends to a redness a smooth edge is produced. A rather more satisfactory instrument can be made with a larger size of tubing at 20 cents a foot. The glass ends consist of a pair of tube connectors of large diameter, which are worth about 5 cents each. It is worth while to heat to redness one end of each of these connectors and expand it a little with any convenient metal tool so that a small cork can be used to hold the water when the instrument is not in use. So corked, the tubing with its supply of water can be carried in the pocket for days at a time without any risk of leakage.

The grade per cent is the ratio of the perpendicular to the slope and is not the same as the grade measure used by surveyors which is a certain number of feet in 100, which deals with the ratio of the perpendicular to the horizontal.

Table No. 2 has been calculated on a basis of a height of eye of 5 ft. 4 in., which equals 5.33 ft. The length of pace taken is 2.5 ft., and shows for each grade per cent the distance in paces to the point on the grade where the eye level intersects the road. It is correct for one whose height is 5 ft. 8½ in. It is also approximately correct for an eye level 1 in. greater or 1 in. less. On a 1 per cent grade the higher eye level would be 216 paces and the lower eye level 210 paces, a difference too slight to be of any importance. Similarly, on a 10 per cent grade, the number of paces would be 21.6, 21.5 and 21.2 respectively. This difference also would be immaterial.

TABLE II.

Grade.	Paces.	Grade.	Paces.
1%	213	14%	15
2%	106.5	15%	14
3%	71	16%	13
4%	53	17%	12.5
5%	42.5	18%	12
6%	35.5	19%	11
7%	30.5	20%	10.5
8%	26.5	21%	10
9%	24	22%	9.5
10%	21.5	23%	9
11%	19	26%	8
12%	18	30%	7
13%	16.5	35%	6

With respect to this table it should be noted that up to about 5 per cent grade a considerable error in pacing would hardly be appreciable, but on the other hand, the reading of the level would be uncertain by several paces, while for 10 per cent and above the level reading would be quite exact

(*Continued on page* 258)

The FORVM

A Test of Vacuum Brakes

WITH reference to the criticism by H. M. Brayton on the vacuum brake, the editorial note which you published in connection with this letter completely covers the criticism. As a matter of interest, the accompanying table represents the results of a test made on the Indianapolis speedway in a 1917 twelve-cylinder Packard which had been run 2000 miles. It will be noticed that the vacuum rises as high as 25 in. when the car is traveling faster and the foot is taken off the accelerator pedal. From 10 to 14 in. in the manifold will give sufficient atmospheric pressure to do the necessary braking on the largest car on account of the leverage links employed in connection with the brake cylinder.—Prest-O-Lite Co., Inc., Indianapolis.

M.P.H	Vacuum running	Releasing accelerator
10	14"	18"
15	15"	19"
20	15"	22"
25	15"	22"
30	15"	23"
35	15"	25"
40	10"	25"

Suggests Steam Cooling

By W. W. Wells

THERMOSTATIC control of engine temperatures is a decided improvement over no control, but the principal reason for keeping the temperature as low as 180 deg. Fahr., seems to be the fact that our cooling medium begins to evaporate when much higher temperatures are reached. The water-jacket of an internal combustion engine is a necessary evil, carrying off heat that we would prefer to convert into mechanical energy. We put up with it simply to preserve the machine. If water at atmospheric pressure boiled at a temperature of 300 deg. Fahr. instead of 212 deg., we would probably be using considerably higher temperature than we do now.

Steam Cooling for Economy

The makers of air-cooled engines claim great economy due to the fact that their engines operate at a higher temperature, and I have been told that it is possible to obtain great fuel economy by using live steam in the jackets when testing an engine. Others tell us that raising the temperature of the jacket water does decrease the amount of heat lost to the jacket, but the increase of the amount of heat lost in the exhaust leaves but little net gain.

Charles E. Duryea points out, in THE AUTOMOBILE for Oct. 26 the desirability of maintaining high engine temperature in order to prevent condensation of our present heavy fuels, and recommends an air-cooled two-cycle engine as a solution of the problem. The constant compression of the two cycle should be a decided advantage, and air cooling would give *high* temperature, but not a *uniform* temperature. The variations of temperature are probably more rapid than in a water-cooled engine, and the range of temperature greater.

I shall not attempt to guess what the best temperature is, but if we could maintain as close regulation as 225 deg. Fahr. as is now obtained by the use of the thermostat, there ought not to be any serious difficulty in the matter of lubrication; and, if the fuel and the air entering the carbureter were also maintained at a fairly high and constant temperature, the problem of carburetion would be very much simplified. It might be feasible to use a shutter, controlled by a thermostat, to limit the circulation of air around the cylinders of an air-cooled engine, but there is another way of obtaining almost any desired temperature, between 212 and 300 deg., and maintaining it within close limits regardless of variations in atmospheric conditions, load or speed.

An Intermediate Tank

A radiator might be built with an intermediate tank placed a little higher than the cylinder heads, and with the portion above this tank arranged to act as a condenser while the lower part acts as a water cooler. The intermediate tank could be divided into two or more sections and the outlet from the engine jacket connected to one of these sections. Then, with the radiator filled only to the height of this tank, the water circulates through only a portion of the cooler section, as long as no steam is formed. That is equivalent to using a very small radiator until the engine gets warmed up.

When the water begins to boil, steam enters the intermediate tank and passes up into the condenser. This condenser is arraged so that the steam passes through a considerable length of cooling surface, where it is condensed, and then into the other section of the tank, and this water of condensation is cooled while passing to the lower tank. The radiator could be made large enough to prevent loss of water in the hottest weather, and yet have all the advantages (and more) of the small radiator as pointed out by Mr. Duryea. *The effective radiating surface increases or decreases exactly as needed to meet varying conditions.* The jacket temperature is always 212 deg. Fahr., after the engine is once warmed up. This is about 30 deg. warmer than is customary with thermostatic control.

But if higher temperatures are desired, place a safety valve in the radiator vent, set for 5 lb. per sq. in. and the temperature goes up to 227 deg.; but it stays there only as long as steam is being generated as fast as it is being condensed. A decrease in the load on the engine, or an increase in the effectiveness of the condensing surface, such as might result from a change in the direction of travel in relation to the wind, would cause a drop of pressure and temperature.

To maintain a *constant* temperature of 227 deg., we would have to have a supply of air at 5 lb. pressure, to fill that portion of the condenser not filled with steam.

It is not necessary, however, to maintain pressure in the radiator, since it is only in the jackets that we need this higher temperature. The centrifugal pump used for circulating the water could be replaced by a positive pump that would produce almost any pressure desired; and with a pressure regulating device in the outlet from the engine, we could maintain any desired pressure in the water jacket and yet have the radiator operating under atmospheric pressure. The pump should have capacity enough to supply more water than could be evaporated at full load, but less than would cool the engine without boiling at light loads. With this arrangement, the radiator could be all condenser instead of part condenser and part cooler.

It does not appear difficult to maintain quite high pressures in this way. A pressure of 52 lb. would mean a temperature of 300 deg. Fahr., or 149 Cent. in the jacket, with correspondingly higher temperatures for the cylinder walls. The steam in passing from the engine to the radiator is capable of doing quite a little work, and might be used to drive the fan, automatically increasing the speed of the fan as needed.

With steam-jacketed carbureter and intake manifold and a steam heater for the air entering the carbureter we would have a uniformity of conditions for the gas making apparatus that is impossible when depending on exhaust heat. The carbureter could be accurately adjusted to these conditions, and with the higher temperatures, as mentioned above, it might be possible to burn kerosene without the use of the exhaust heat.

Investigate Higher Temperature Possibilities

Some object to higher temperature on the ground that an engine will not run as smoothly at 200 deg. as it will at 175 deg., but is this an inherent disadvantage or is it due to the fact that our engine designs are based on experience with water cooled engines? Would it not be possible to design an engine that would run as smoothly when the jacket water is boiling as when it is warm? Since hopper cooled stationary engines and air-cooled engines operate successfully, it would seem worth while to investigate the possibilities of higher temperatures. The subject may not interest builders of high priced passenger cars but it ought to be of interest to truck manufacturers. Perhaps the builders of stationary engines can tell us something of the relative advantage of a 212 deg. jacket and a cooler one.

Faults in Carbureters

By P. S. Tice

IN THE AUTOMOBILE for Dec. 14, under the heading Lower Fuel Is Greatest Carbureter Problem, J. E. Schipper discusses the requirement of acceleration in a car from the carbureter viewpoint, and leaves the reader with the impression that a reasonable or high rate of car acceleration is only obtained with mixtures that are richer in fuel than that required or used in normal steady running. That this is not and cannot be the case is almost self-evident. However, no reflection is made or is intended upon Mr. Schipper's handling of the case, since it is a fact that those well known carbureters which perform best under acceleration of the engine do, almost without exception, alter the ratio of fuel to air supplied when this demand is made upon them.

But what is really accomplished by this apparent enrichment of the mixture is not an enrichment at all, but is simply the momentary supplying of excess fuel, so that the normal quality of the charge *may not be impaired.* As we are all very much aware, the average fuel supply system is not particularly strong as a fuel vaporizer. Any sudden demand for more mixture imposes a reduction in the relative rate of vaporization going forward at the instant preceeding the demand. Thus, when the throttle is opened to accelerate the car, the heat content and capacity of the system is insufficient to handle the increased amount of fuel. This results in an impoverishment of the mixture, considering only its active portion consisting of vapor and air. The expedient, naturally, is to supply more fuel under this condition, so that the mixture may be kept normal, or more nearly so, in the matter of its vapor content. Obviously, this is at the expense of fuel, since only the more volatile portions can be used under the then condition of low vaporizing capacity in the system as a whole.

It is a conclusion based on experimental evidence and observation of the field that all acceleration wells and their equivalents are expedients adopted by the makers of carbureters embodying them to correct in some measure for the weakness of present-day carbureting methods. No one will argue that the modern carbureter is not a marvel of perfection in the way it handles the problem of proportioning of the mixture. Its perfections are the more apparent when one considers the almost absolute lack of support offered the carbureter by the other components of the systems in use.

It is the experience of the writer, and, it is believed, of some other workers in the field, that the simplest of all carbureter designs will give perfect results on all points, and particularly in the matter of acceleration of the car, if provisions are made for the complete evaporation of the fuel somewhere in its travel between carbureter nozzle and the combustion chambers. With a full realization of fuel evaporation, it is unnecessary and wholly undesirable that the mixture proportions be disturbed by the action of a well or similar auxiliary at the time of acceleration. This is but one of the counts on which such a system scores over the conventional lay-out in the matter of economy and general desirability of performance.

Favors Lower Tire Pressures

By R. H. Upson

Goodyear Tire and Rubber Co.

IN Forum of THE AUTOMOBILE for Dec. 21, O. B. Parkinson, brought out the point that if the printed advice of the tire manufacturers as to the degree of inflation was rigidly adhered to, many tires would be pumped too hard. Some of the points brought out in Mr. Parkinson's recommendations, are at least questionable, but in the main proposition I wish to say his views are entirely in accord with at least one of the foremost tire manufacturers.

The main trouble with the old inflation schedule was the fact that it was good for only one set of conditions and those conditions included the assumption of maximum load on the tire and practically no comfort for the passengers. P. W. Litchfield discussed this subject in detail at the summer meeting of the Society of Automobile Engineers in June, 1915, this article being reprinted in whole or in part, in most of the current issues of automobile magazines. In it he brings out the development of a loading and inflation schedule which will be practical and at the same time sufficiently flexible to meet the various conditions and requirements of the user.

Suggests Inflation Scale

The table referred to is the result of painstaking investigations with tires, both in the laboratory and on the road, and the figures were chosen with due regard to ease of riding as well as other items. The illustration shows celluloid scales by which can be figured graphically the proper inflation of any tire. The "inflation and load scale" gives the best *average* pressure for various degrees of loading on tires of different sizes. The "calculator" goes deeper into the problem. By its use one can figure for any given car and external conditions, just what advantages may be obtained by varying the inflation pressure or the size of the tires, on the same car. The use of this latter device pre-supposes some definite recorded experience with tires on the road. The successful use of a reasonable inflation scale depends upon the ability of the American motoring public to appreciate its limitations and not abuse it. I believe that the time has come when such a scale can and should be universally adopted.

Inertia and Stroke Ratio

By Edward G. Ingram

I HAVE read the interesting paper by A. F. Milbrath published in THE AUTOMOBILE for Jan. 11, but beg to differ from his views in one point. In speaking of reducing reciprocating weight he says: *"A small diameter of cylinder with a long stroke is favorable since the weight of a piston increases with some power of the diameter between the second and third, and the inertia forces of the piston vary likewise as long as the piston speed is constant."*

This is an entirely unsatisfactory way of comparing the inertia forces of long and short stroke engines because these forces should be compared at equal power output, and this will not be developed at equal *piston* speeds but at equal

r.p.m. That is, each cylinder of say a 300 cu. in. engine will be taking in and discharging the same amount of gas per minute at equal r.p.m. no matter what the stroke bore ratio, but *not at equal piston speeds.*

Now if the bore of a long stroke engine is increased and the stroke decreased, the displacement remaining the same, the pistons will of course be heavier, but the *piston speed will be lower.* It is the case of a greater weight moving at a lower speed and one will tend to offset the effect of the other.

It can be proved mathematically that the inertia forces of engines of the same displacement will be the same if the piston weight is inversely proportional to the stroke, and I believe in practice that this will tend to be true. I agree entirely with Mr. Milbrath's statement that the long-stroke engine will be heavier than the short-stroke of equal volume.

Simple Methods for Testing Car Ability

(*Continued from page* 255)

within less than one pace, but an error in pacing, even a single pace, would make a material difference. Of course one can construct his own table by taking any height of eye, as, for example, 5.1 ft. A slope of 510 ft. would be a 1 per cent grade; dividing by 2½ to reduce it to paces equals 204. This again may be divided by 3, 4, 5, etc., the different per cent grades, resulting in the number of paces for each corresponding grade.

The resistance in pounds per ton and the grade per cent bear fixed relations to the change of speed in feet per second, which may be stated as follows:

A = acceleration of retardation in ft. per sec., per sec.
R = resistance in lb. per ton of 2000 lb.
G = grade per cent, considered not as a decimal but as a whole number.

Then;

A = 0.32 ft. (or nearly 4 in.) for each 1 per cent of grade.
R = 20 lb. for each 1 per cent of grade.

If G is given, multiplying it by 0.32 gives the corresponding A, and multiplying it by 20 gives the corresponding R.

If A is given, it may be divided by 0.32 to obtain G or multiplied by the constant 62.5 to obtain R.

If R is given, it may be divided by 20 to obtain G and by 62.5 to obtain A.

If it is desired to translate the results of the above-mentioned experiments into horsepower, the formula is as follows:

$$\text{H.P.} = \frac{T \times \text{m.p.h.} \times R}{375}$$

In this equation T equals the weight of the car with its full complement of passengers, gas, etc., in tons of 2000 lb., m.p.h. equals the speed in miles per hour. R equals the number of pounds of resistance per ton. The 375 is a constant derived from cancelling out 88 ft. per min. at 1 m.p.h. in the enumerator as against 88 × 375 (equals 33,000) in the denominator.

Establishments of Chile's Largest Accessory Dealer

The accompanying illustrations represent the three garages, supply and accessory stations of Ahumada & Co., Santiago, the largest dealer in accessories in Chile. These stations supply 75 per cent. of the gasoline used in Santiago. There are 2000 cars in this city, 70 per cent. of which are U. S. A. automobiles of various makes

Conferring Individuality on an Old Car

By Redesigning Body, Fenders, Hood, Radiator, Windshield and Top Old Models May Be Successfully Rejuvenated

By D. R. Martin

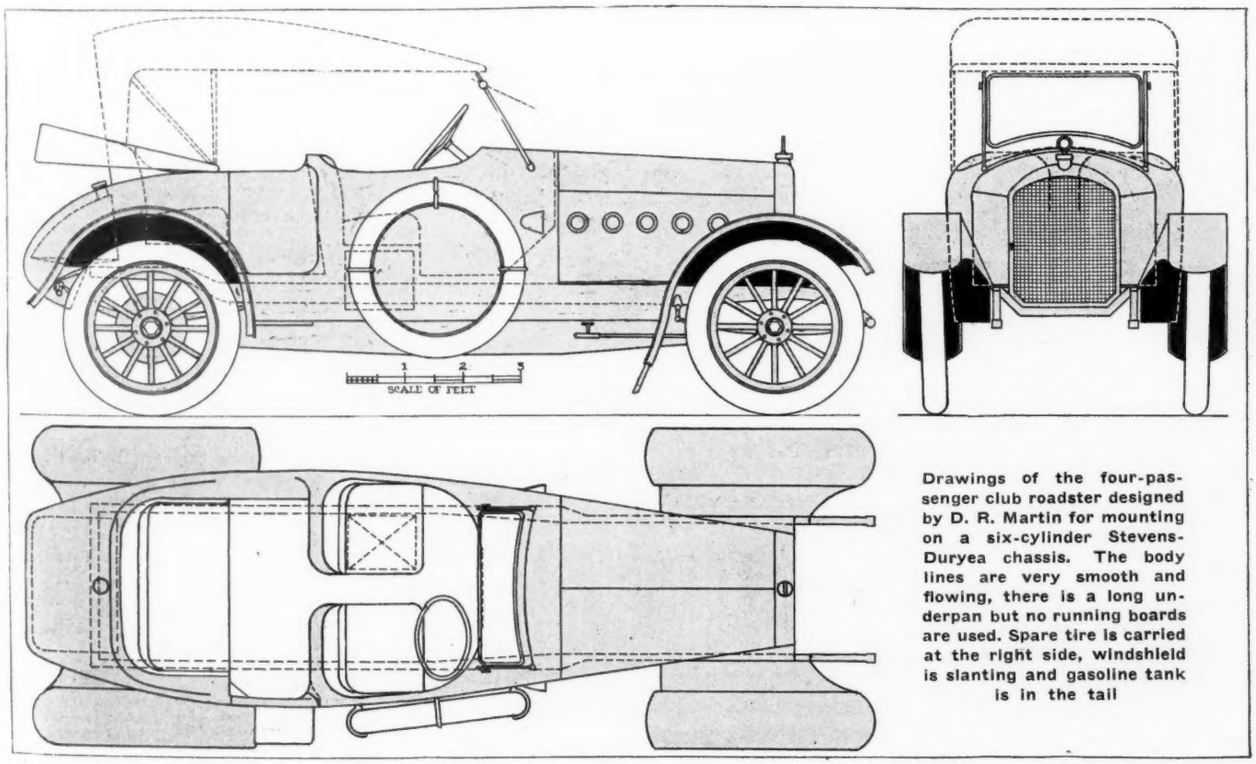
DISTINCTIVELY individual automobile designs are in greater demand every day. Not so very long ago a man was entirely satisfied with a car, the exact duplicate of which could be seen on every side of him. But of late, there is a stronger desire for something entirely different, a longing for a car that is different from any car in the world. This desire may be satisfied, in the case of some owners, by an individual color scheme on some standard make of car; but for others, the necessary differentiation can only be obtained a so-called special or custom body. The farther a custom design differs from the standard, the more comment and attention it will draw. Generally a custom body will require specially designed fenders, hood, radiator, windshield and top to insure a pleasing and harmonious scheme from the ground up and from the front to the rear bumper. But there are always certain limitations imposed by the chassis which will govern the design in general. However, the present day chassis will admit of innumerable custom designs and with a little forethought in the selection of the chassis one may satisfy practically any individual taste. The necessary expenditure for a custom design is relatively like anything else—the more and better one desires, the greater will be the cost.

Three Distinct Advantages

First—One may have just what he desires; a high or low, long or short, narrow or wide body; one, two, three, or four doors; seating for any number of passengers with standard or low seats; in fact, everything as he desires and to meet his individual requirements, and, incidentally, his pocketbook.

Second—One may well take pride in such a creation, and why should he not? Everything is just as he wanted it. There never was a custom design that did not create interest and comment wherever it was driven and all this comment is bound to be favorable providing the design is entirely "possible" and not an "unusable freak." Such general interest in one's car is a great incentive to keep it always looking and running at its best so that the result of close examination by the ever-present curious will be nothing but pride in ownership.

Third—The writer wishes here to express a very great advantage which has never been mentioned in connection with custom designs. The custom designed car is much less liable to be stolen because the possible thief realizes the comparative ease with which such distinctive designs may be apprehended. The authorities as well as the motoring public soon learn to associate the rightful owner of such a car with the car itself. And as for petty thefts, such as tires and accessories, such a car is never without some attention from the curious, even though standing in a comparatively secluded parking space and this very fact tends to discourage such thefts. What should also be considered as an advantage is the fact that the driver of such a car must observe the rules of the highway and all traffic laws to a greater extent than



Drawings of the four-passenger club roadster designed by D. R. Martin for mounting on a six-cylinder Stevens-Duryea chassis. The body lines are very smooth and flowing, there is a long underpan but no running boards are used. Spare tire is carried at the right side, windshield is slanting and gasoline tank is in the tail

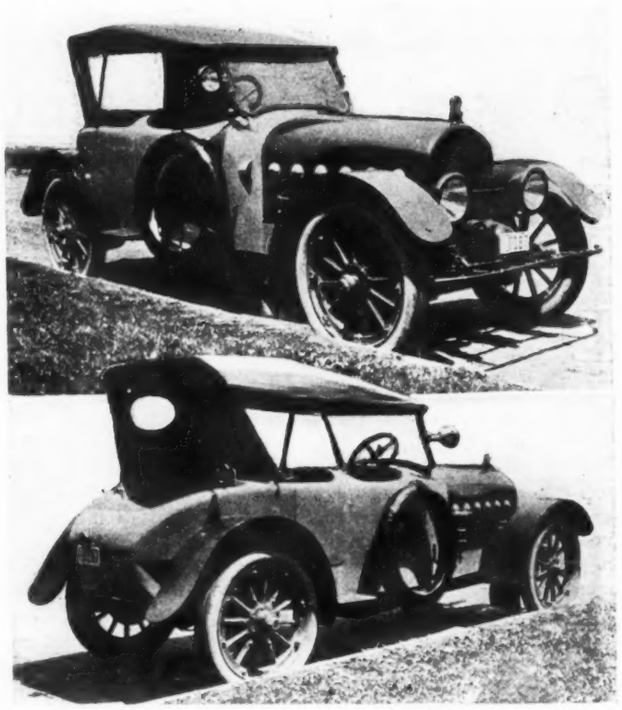
the driver of a standard car, because there are more eyes on him.

A Custom Design

The writer herewith presents a design of a four-passenger club roadster which has proven so entirely satisfactory after 4 months' driving that nothing in the design would be altered if he were to build it again, and certainly the proof of a car is the driving of it. The chassis used is a Stevens-Duryea six-cylinder of 130-in. wheelbase, with right-hand drive and control. The hood and body lines flow back from the radiator without any reverse curves or swells, giving the much desired fast and racy lines. The body has but one door and the front seats are divided with a 7-in. aisle between them. There are no running boards of any kind, a small step under the door giving access to the car, and the body sides are carried well down below the frame line. The rear of the body is a full turtle-back with a complete under-sweep, the rear seat setting into the body lines and not running into them. The front seat backs form a double cowl and the body sides have a slight kick-in for the lower third and a tumble-home for the upper eighth. The instrument board sets flush with the back of the cowl and is metal covered and painted the same color as the body. The radiator is of special design, being high and narrow with well rounded corners. The fenders are also of special design with long leather splashers on the front. The windshield is set at a rake and secured to the cowl by means of a special aluminum casting. The spare tire is carried on the right side of the body where same can be removed without danger from passing cars and the horn is carried on the left side of the body—and not under the hood—where it can be used to the best advantage. Six port-hole vents in each side of the hood allow for discharge of the air from the fan and an eye-brow vent on each side of the body with movable louvres inside give the required ventilation to the cowl compartment. A graduated curved pan incloses the underside of the chassis from front to rear and from body side to body side, giving a very neat and finished appearance underneath. The entire body, including the body filler sides under the hood and the port-hole vents, is painted a deep cream; the wheels, fenders, radiator, hood, horn and windshield are a light olive green; the running gear a Brewster green; and the top and upholstery black.

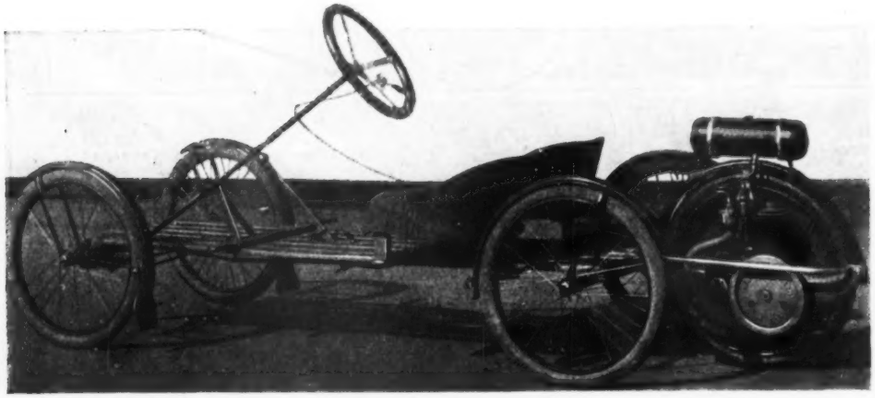
For the benefit of the skeptical the writer wishes to remark upon the apparent innovations as follows—the absence of the running boards is not a disadvantage from the standpoint of keeping the body clean as during 4 months' driving there has not been a spot of mud thrown on the body by the car itself—of course mud from passing cars cannot be avoided; and the undersweep of the turtle-back at the rear of the body and the complete underneath pan are a decided advantage as far as protecting the occupants of the rear seat from road dust is concerned, which is proven by the fact that even with the rear top curtain rolled up there is much less dust in the rear seat than with the old type of body design and the rear curtain fastened down. In addition to this the writer wishes to say that the long cowl with the windshield set well ahead gives excellent protection to the occupants of the front seats in inclement weather and in warm weather the eye-brow vents supply plenty of ventilation. The color scheme has proven a decided advantage over the darker colors because of the fact that a heavy coat of dust is scarcely perceptible even when observed from close up to the car.

In conclusion the writer must say that he is more than pleased with the design and very evidently is not the only one judging from the many favorable comments passed



Two views of the Stevens-Duryea six fitted with distinctive four-passenger club roadster body designed by D. R. Martin

Smith Flyer Buckboard Driven by Motor Wheel

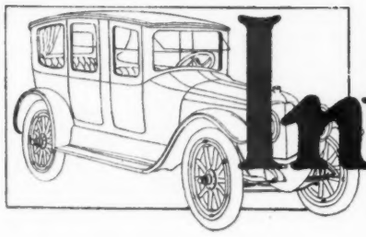


Smith Flyer two-passenger four-wheel buckboard driven by Smith motor wheel

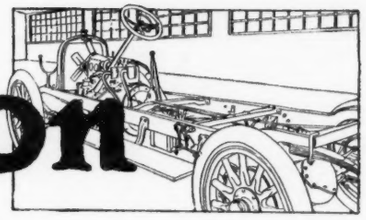
THE Smith Flyer, manufactured by the A. O. Smith Co., Milwaukee, Wis., is a light and sturdy motor vehicle made from a four-wheeled buckboard with a Smith motor wheel attached to the rear. This machine, though its entire weight is but 135 lb., is capable of running at 20 to 25 m.p.h. and one can go from 80 to 90 miles on 1 gal. of gasoline.

The control consists of a small thumb lever attached to the steering wheel and clutch and foot brakes are the same as those on a regular automobile. The wire wheels are fitted with double tube clincher tires and are 20 in. in diameter. The wheelbase is 70 in. and the tread is 30. The motor wheel is lifted about an inch off the ground by means of the clutch and is cranked by a handle on the drive wheel. By letting out the clutch the wheel is dropped to the ground. Price, $125, f.o.b. Milwaukee.

The body is fully equipped with tan upholstered seats, is made of natural wood with mudguards, and metal parts are nickel plated. In winter the wheels can be removed and sled runners attached, making it a motor sled.



Information



¶ In a recent issue of THE AUTOMOBILE the Rostrum, as a department devoted to answering the questions of readers and to publishing communications of general interest, gave way to Information. In the new form a higher efficiency is aimed at by economy of space and a method of direct reply.

QUERY—In converting a Ford into a speedster, advisability of using racing camshaft and where obtainable. 2—Timing with new shaft. 3—Need for larger manifold if valve enlarged. 4—Value of aluminum pistons and controlling connecting-rods. 5—Possibility of removing Ford magneto without injuring lubrication. 6—Method of lowering rear springs, using original springs.

(10) Nocona, Tex. Q. S. G.

—This can be obtained from E. R. Noonan, Paris, Ill.

2—Refer to 1.

3—It will not be necessary.

4—We would advise using aluminum pistons, but we would not advise drilling holes in the connecting-rods.

5—Only the magnets of the magneto should be removed.

6—Cut off the frame 4 in. from the rear end, and support the rear spring cross-member with angle irons.

? ? ?

Query—Horsepower curve of Lozier light four type 84, 1914 model, built on raceabout lines, weighing 3600 lb., geared 3 to 1 on direct. 2—Would aluminum pistons of good alloy, such as Lynite, raise the effective revolution per minute to any appreciable extent? 3—Would it be feasible to substitute for the roller in the rocker that rides between the cam and valve lifter a suitable piece of steel with the side of same that touches the cam finished almost flat? A quicker opening of the valve would result, but would it result in very much power increase? 4—The portion of the intake manifold outside block is 1½ in. in diameter with the cored-in portion about 2 in. in diameter. Zenith 1½ in. carbureter installed. Would not an air valve, hand operated, in conjunction with a larger main jet, give the effect of a larger carbureter?

(13) Chazy, N. Y. R. J. M.

—The following figures will give the characteristics of the curve:

600 r.p.m. 25 hp
1000 r.p.m. 42 hp
1500 r.p.m. 52 hp
1800 r.p.m. 55 hp

1800 is the peak of the curve.

2—Probably not.

3—It is very doubtful if the gain would be appreciable.

4—Probably not. In any case it would be cumbersome. A device much used in Europe consists of a ⅜ in. hole drilled in the intake manifold on the engine side of the throttle. From this a copper pipe is carried to a convenient place on the steering column and a cock with about ⅜ in. bore forms the end. This allows additional air to be admitted when running fast and generally cuts the gasoline consumption, but it has to be manipulated continually.

? ? ?

Query—Wiring diagram of electric and ignition system, also carbureter of Hudson Super Six.

(19) Fillmore, Cal. E. C. K.

—Wiring diagram of electric system and carbureter of Hudson Super Six illustrated below and on next page.

? ? ?

Query—Would the chassis of a model 34 Oakland stand the increase in power if a Rutenber model 25 motor with Brown-Lipe transmission were substituted for the motor and transmission now used? 2—Brake horsepower of Rutenber 25, Northway 108 and Falls model J at 1600 and 2000 r.p.m. 3—Length of spring centers of model 34 Oakland front and rear and of Franklin runabout.

(15) Syracuse, N. Y. H. E. M.

—It would be very unsafe to put so large a power plant in the Oakland 34 chassis.

2—Rutenber 41 and 44 hp., Northway 32 and 38 hp., Falls 26 and 33 hp.

3—Front 35 in., rear 51 in. on the Oakland, and on the Franklin 36 in. both front and rear.

? ? ?

Query—Can 35 by 4½ in. tires be fitted on 34 by 4 in. rims?

(20) Emporium, Pa. J. H.

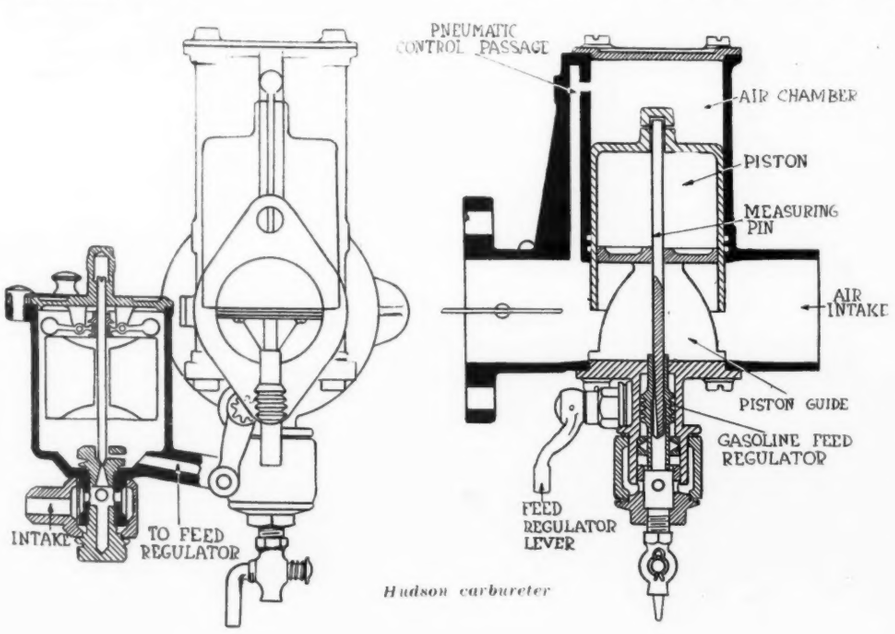
—Yes, they are the standard oversize.

? ? ?

Query—Highest average temperature of cylinders of an automobile such as the Franklin and racing cars.

(21) Los Angeles, Cal. L. D. C.

—About 200 deg. Fahr.



Hudson carbureter

Query—How to remedy oil getting past piston rings into combustion chamber and fouling plugs forming carbon in 1916 Studebaker. Could the pistons be taken out through the bottom of the crankcase without taking cylinder off?

(16) New York City. J. B. J.

—Possibly your piston rings are worn and require renewal. It is possible that the splashers on the lower ends of the connecting rods are dipping too deeply in the oil. Take the matter up with the Studebaker service station.

? ? ?

Query—How foot brakes can be made to give better retardation on 1913 Pierce-Arrow weighing about 5000 lb. Have just relined them with Raybestos, but have the same trouble when stopping.

(17) Radnor, Pa. R. A. C.

—After relining readjustment is soon required since the fabric beds down somewhat. If relining is properly done the brakes should be in perfect condition after about 300 miles driving.

? ? ?

Query—Difference in the winding of the ignition coils on two, four, six, eight or twelve-cylinder engines? 2—Difference in the condenser in these coils? 3—Diagram showing the internal winding of the 1916 Wagner generator? 4—The Dyneto motor-generator has six poles, three series field and three shunt. How do they control each other? 5—What are the weights of the general run of racing cars?

(14) Philadelphia, Pa. C. T.

—No difference. Only one is used in any case. The difference occurs in the number of times the primary circuit is made and broken during a revolution of the crankshaft.

2—No. The condenser is in the same situation as the coil.

3—The Wagner company makes several types of generator and will make practically any designs asked for. If you have any particular machine in mind please specify it.

4—The connections are such that the excitation of the series fields opposes that of the shunt fields as the speed of the generator increases. When the machine is operating as a motor the two work in harmony.

5—From 2000 to 2500 lb.

? ? ?

Query—How to test cylinder oil to tell if it is good. 2—Weight of the new four-cylinder Studebaker. 3—Advantages of disk clutch over cone, and vice versa. Which is best, one with few disks or with many and why? 4—Reason for motor pounding when hot. 5—Could I admit water through V air valve attached to manifold to remove carbon?

(18) Bouton, Iowa. C. M.

—Testing cylinder oil except by using it is a very complicated laboratory process requiring considerable expensive equipment. In any case, the final test is the use of the oil in an engine. There is no easy test for an amateur.

2—Studebaker manufacturers state this to be 2770 lb. for the touring car.

3—This is a much debated subject on which no agreement has yet been reached. The cone is simpler, the disk is lighter and easier to reface. The number of disks when large gives the lowest pressure per square inch required, but few disks usually "free" more readily with less pedal movement.

4—Probably due to pre-ignition caused by carbon.

5—You cannot remove carbon already deposited by adding water. Better have the engine torn down and scraped.

? ? ?

Query—Method of adjusting Marvel carbureter on 1916 Buick light six. After cleaning this has been troublesome at between 15 and 20 m.p.h. 2—Advisability of retreading tires when fabric is cut.

Mentor, Ohio. A. M. B.

—The air valve in the Marvel carbureter should fit tightly against the wall of the chamber and must not touch the high speed jet when it is in this position.

2—No, not if the fabric is either cut or rotted.

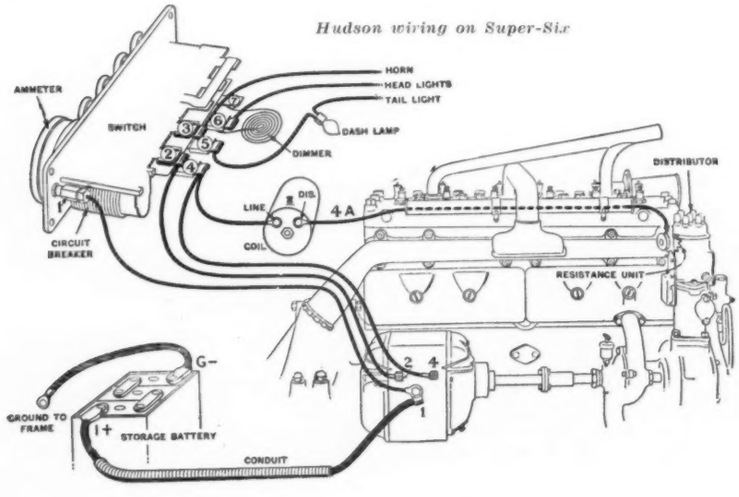
? ? ?

Communication—Among the multitude of troubles that an automobile driver has to deal with, bearing trouble certainly can be given a prominent place. When, however, this bearing trouble cannot be remedied by adjustment, cleaning of the oil holes or use of better oil, it becomes a regular menace. Such a peculiar case showed the following symptoms: The bearing next to the flywheel would heat for a day or two and then would not heat for a few months. Then all of a sudden it would repeat its trick. It was found that the heating occurred as a rule after the engine had been working hard, as for instance, after climbing a steep hill. The course of this trouble was not located until one day the crankshaft broke. The break clearly showed by a series of rings that it had taken several months before the shaft finally gave out. This explained the heating of the bearing. After a sudden strain the shaft would be slightly bent and it would take several days before it would have worn down the bronze bearings sufficiently to obtain a large enough surface that would not heat.

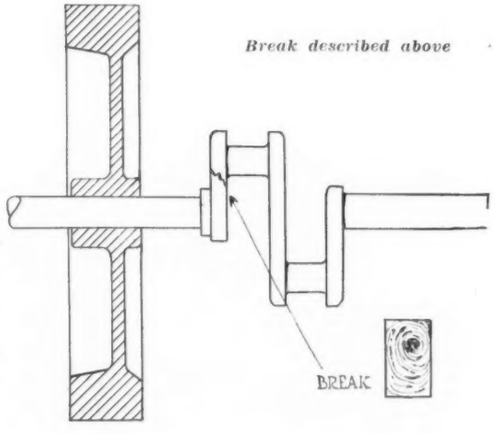
The accompanying illustration shows the place where the break occurred and also shows a cross section of the break. It is interesting to note that the final break did not occur in the center but in the right hand upper corner, this being due to the uneven strain caused by the explosions.

(11) New York City. A SUBSCRIBER.

Hudson wiring on Super-Six



Break described above



Industrial Miscellany

Factory

Ohio Forge Co., Cleveland, has purchased 4 acres of land which will be used for the location of a new plant to be erected at a cost of $100,000.

Fisk Rubber Co., Chicopee Falls, Mass., has started moving into its new mill, which is 600 ft. long, 105 ft. wide and has six floors.

Star Rubber Co. at Akron, Ohio, has started production in its plant, and every effort is being made to place the factory upon a basis of complete production as rapidly as possible.

Willys-Overland Co. will add 200 employees within the next week to its branch in Elyria, Ohio, to increase the capacity of the plant to meet the heavy demands now being made on it.

Apperson Brothers Automobile Co., Kokomo, Ind., has completed the last of the new buildings and has succeeded in transferring all of the machinery from the old plant to the new. The new plant gives it an additional floor space of nearly 500,000 sq. ft., and practically doubles the acreage of its buildings. Nearly $300,000 has been invested in new machinery and the buildings themselves.

Reo Motor Car Co. employees have arranged a plan to reduce the cost of winter motoring in Lansing, Mich. They designate certain individual workers to use their cars for specified periods, and these drivers pick up all other employees on their way to the factory. Once a week operating expenses and repair bills are audited and the total pro-rated among the riders. The owner of the car has the use of it at all other times.

Lasure Friction Clutch Pulley Co., Charles City, Iowa, manufacturing clutch units for gasoline engines, has moved its plant and general offices to Madison, Wis. The factory at 619 Williamson Street, Madison, has been equipped and is now producing fifty clutch pulleys daily.

W. A. Walker Mfg. Co., Racine, Wis., recently moved into its new plant at North Michigan and Hamilton Streets and is now operating with increased forces. The payroll has been increased from 100 to 150.

Gilson Mfg. Co., Port Washington,

The Automobile Calendar

ASSOCIATIONS

Jan. 24-26 — Chicago, Second Annual Meeting National Assn. of Automobile Accessory Jobbers. Congress Hotel.

CONTESTS 1917

April—Los Angeles to Salt Lake City Road Race.
May 19—New York Metropolitan Race on Sheepshead Bay Speedway.
May 30—Indianapolis Speedway Race, Championship.
June 9—Chicago, Ill., Speedway Race, Championship.
June 23 — Cincinnati, Ohio, Speedway Race.
July 4—Omaha, Neb., Speedway Race, Championship.
July 4—Tacoma, Wash., Speedway Race, Championship.
July 14 — Des Moines, Iowa, Speedway Race, Championship.
Aug. 4—Kansas City Speedway Race.
Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 29—New York, Speedway Race, Championship.
Oct. 6—Kansas City Speedway Race.
Oct. 13 — Chicago, Speedway Race.
Oct. 27—New York Speedway Race.

SHOWS

Jan. 20-27 — Montreal, Que., Almy Bldg., Automobile Trade Assn.
Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.
Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 22-27—Manchester, N. H., Academy.
Jan. 22-27 — Buffalo, N. Y., Show, Broadway Auditorium. Buffalo Automobile Dealers' Assn.
Jan. 22-27—Scranton, Pa., Board of Trade Bldg., H. B. Andrews, Mgr.
Jan. 23-27—New Bedford, Mass., State Armory, Stephen W. Pierce, Mgr.
Jan. 23-27 — Oklahoma City, Okla., Show, Auditorium.
Jan. 23-27 — Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 24-27—Lewiston, Pa., First Annual.
Jan. 24-29—Charleston, W. Va., Armory.
Jan. 25-27—Asheville, N. C., Show, Asheville Automobile Trade Assn.
Jan. 27-Feb. 3—Richmond, Va., First Annual, Gray's Armory.
Jan. 27-Feb. 3—Columbus, O., Show, Memorial Hall, Columbus Dealers' Assn.
Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.
Jan. 27-Feb. 3—Portland, Ore., Eighth Annual, Dealers' Motor Car Assn. of Oregon.
Jan. 27-Feb. 5 — York, Pa., Show, York Automobile Dealers' Assn.
Jan. 28-Feb. 3 — Wilmington, Del., Show, Hotel duPont.
Jan. 29-30—London, Ont., Victor Carty, Mgr.
Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.
Feb. 5-9—Boston, 8th National Good Roads Show, Mechanics' Bldg.
Feb. 5-10—Indianapolis, E. W. Steinhart Bldg., Indianapolis Automobile Trade Assn.
Feb. 5-10—Bangor, Me., Bangor Automobile Assn., Auditorium.
Feb. 5-10—Indianapolis, Ind., Indianapolis Automobile Trade Assn., Steinhart Bldg.
Feb. 7-10 — Bay City, Mich., Automobile and Accessories, Armory, F. D. Shaver, Mgr.
Feb. 7-11 — Kalamazoo, Mich., State Armory, Kalamazoo Automobile Dealers' Assn.
Feb. 8-15—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.
Feb. 10-17 — Harrisburg, Pa., Harrisburg Automobile Dealers' Assn., J. Clyde Myton, Mgr.
Feb. 10-17 — Hartford, Conn., Show. State Armory, First Infantry.
Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.
Feb. 12-17 — Bay City, Mich., Show, Armory.
Feb. 12-17 — Louisville, Ky., Show, First Regiment Armory, Louisville Automobile Dealers' Assn.
Feb. 12-17—Toledo, O., V. G. Kibby, 1017 Jefferson Ave.
Feb. 12-19 — Indianapolis, Ind., Show, Steinhart Bldg., Indianapolis Automobile Trade Assn.
Feb. 13-15—Grand Forks, N. D., Auditorium, Automobile Dealers' Assn.
Feb. 13-17 — Williamsport, Pa., Armory, John Kelly, Mgr.
Feb. 14-17—Peoria, Ill., Coliseum, Automobile and Accessory Dealers' Assn.
Feb. 15-17—Racine, Wis., Chas. A. Myers, Mgr.
Feb. 17-24—Albany, N. Y., Sixth Annual, State Armory, Albany Automobile Dealers' Assn.
Feb. 17-24 — Newark, N. J., Show, First Regiment Armory.
Feb. 18-25 — St. Louis, Mo., Show, Automobile Manufacturers' and Dealers' Assn.
Feb. 19-24 — Springfield, Ohio, Show, Memorial Hall, Springfield Automobile Trade Assn.
Feb. 19 — Pittsfield, Mass., Show, Armory, J. J. Callahan, Mgr.
Feb. 19-24—Portland, Me., Exposition Building.
Feb. 19-24 — Grand Rapids, Mich., Show, Automobile Business Assn. of Grand Rapids.
Feb. 19-24 — Duluth, Minn. Show, Duluth Auto Dealers' Assn., Armory.
Feb. 19-24 — South Bethlehem, Pa., Show, Coliseum.
Feb. 19-24—Bridgeport, Conn., Show, Armory, Coast Artillery Corps.
Feb. 19-24—St. Louis, Overland Bldg., St. Louis, Auto Dealers' Assn.
Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.
Feb. 19-24—Pittsfield, Mass., J. J. Callahan, Mgr.
Feb. 21-24—Flint, Mich., Coliseum, Lake Side Park, E. W. Jeffers, Mgr.
Feb. 24-March 3 — Brooklyn, Show, 23rd Regiment Armory.
Feb. 24-Mar. 3—Atlanta, Ga., Automobile Dealers' Assn., Auditorium.
Feb. 26-March 3—Omaha, Neb., Show, Auditorium, Omaha Automobile Show Assn.
Feb. 26-Mar. 3—Utica, N. Y., Utica Automobile Dealers' Assn., State Armory.
Feb. 26-Mar. 3—Wilkes-Barre, Pa., Hugh B. Andrews, Mgr.
Feb. 27-March 4—Atlanta, Ga., Show, Auditorium, Atlanta Auto Trades and Accessory Assn.
March 1, 2, 3 — Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co., Armory of the University of Ill.
March 3-10 — Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.
Mar. 3-10—Washington, D. C., Middle Atlantic Motor Assn., Inc., Union Bldg.
Mar. 5-10—Jamestown, N. Y., Jamestown Automobile Dealers' Assn., Armory. C. A. Hanvey, Mgr.
Mar. 6-9—Fargo, N. D., A. Hanson, Mgr.
March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.
March 7-10—St. Joseph, Mo., Auditorium, St. Joseph Automobile Show Assn.
March 13-16 — Fargo, N. D., Armory and Auditorium.
March 14-17—Mason City, Ia., Armory, Mason City Automobile Dealers.
March 14-17—Davenport, Iowa, Show, Coliseum Bldg., Tri-City Auto. Trade.
Mar. 14-17—Trenton, N. J., J. L. Brock, Mgr.
March 17-22 — New Haven, Conn., Show, Hotel Taft.
Mar. 17-24—Pittsburgh, Pa., Motor Square Garden, J. J. Bell, Mgr.
March 18-23—Cedar Rapids, Ia., Cedar Rapids Automobile Trades Assn.
April—Calumet, Mich., Show, Coliseum, Frank Ketchell, Mgr.
Apr. 4-7—Stockton, Cal., Second Annual San Joaquin Auto Trades Assn., Samuel S. Cohn, Mgr.
Sept. 2-9—Spokane, Wash., Interstate Fair.

Wis., is developing multiple-cylinder engines for use in tractors, trucks and pleasure cars, according to report on good authority. William Baumheckel, tractor engineer, joined the Gilson company Jan. 1 and, it is stated, will devote his time to designing the new line of motors.

Garford Motor Truck Co., Lima, Ohio, has leased a two-story building at 1708-10 Main Street, Kansas City, and will establish a branch factory.

Peerless Tire & Rubber Co., Green Bay, Wis., has been organized with $50,000 capital stock by F. E. Burrall, John P. Jessen and A. W. Brown. It is planned to establish a tire plant in Green Bay by absorbing a company now operating in Ohio.

Progressive Metal & Refining Co., Milwaukee, has broken ground for the first unit of a new plant to afford nearly 55,000 sq. ft. of floor space.

Elyria Iron & Steel Co., with factories at Cleveland, Ohio, and Elyria, Ohio, has completed a large addition to its Cleveland tube mill, which increases its capacity approximately 12,000,000 ft. per year.

The American Forging Co., Birmingham, will install apparatus for making automobile forgings. R. I. Ingalls is president.

Standard Aluminum Co., Two Rivers, Wis., has completed work on a new smelter unit.

Chalmers Motor staff at Detroit is forming an organization to meet daily at dinner in the enlarged convention hall of the company. Plans for this enlargement are already made, and the club will have a special table in the form of a horseshoe, around which they will gather. The daily assemblage will include department heads and men prominent in the administration of the company. Prominent speakers will deliver addresses.

Auto Safety Light Co., Dayton, Ohio, has been formed to manufacture a safety control for automobile headlights. The men at the head of the company are G. F. Dadey, George Holland, G. T. Deal and J. M. Weigand.

Cook Railway Signal Co., Denver, has reorganized and is now in Chicago under the name of the International Electric & Signal Co.

Brown Motors Co., Moline, Ill., will manufacture an annular-valve gasoline and commercial motor for pleasure and commercial vehicles.

National Automatic Tool Co., Richmond, Ind., will build a second addition on its plant for storage and painting of castings.

McFarland & Westmont Tractor Co., Sauk City, Wis., has leased a factory building and equipment, where it will manufacture a new steel tractor.

Portland Body Works, Portland, Ind., will erect a three-story factory costing $15,000.

Auto Safety Light Co., Dayton, Ohio, has been formed by G. F. Dadey and others for the manufacture of automobile specialties.

C. A. S. Products Co., Columbus, Ohio, has secured a contract for 20,000 steering gears from the Harroun Motor Co., Cleveland.

Goodyear Tire & Rubber Co., Akron, has formed a Cosmopolitan Club for its alien employees to teach them American ideals and urge them to qualify for citizenship in the United States.

Blackwell-Welding Co., Dayton, will occupy a new building in Toledo, which will be used for machine and store rooms.

Miller Rubber Co., Akron, Ohio, has secured a permit to erect a $20,000 factory.

Bour-Davis Reflector, Volume One, Number One, has been issued as the house organ of the Bour-Davis Motor Car Co., Detroit.

Personals

F. L. Good has become manager of the wholesale department of the Chicago Motor Car Co., distributor of the Jordan line for territory in Illinois and Indiana. He was formerly general district manager of the Paige-Detroit Motor Car Co., Detroit.

Van N. Marker has again been placed in charge of the Chicago territory of the Adams-Bagnall Electric Co., Cleveland. His headquarters are Machinery Hall, 549 West Washington Boulevard.

H. H. Harwood has been appointed manager of the truck department of the Northwest Buick Co. He will have entire charge of the company's sales of the G. M. C. trucks, Bull tractors and Warner trailers.

O. L. Weaver will be in charge of the exhibition of the Star Rubber Co., Akron, which is to be held in the Auditorium Hotel of that city during the Chicago national automobile show. The company will make exhibits at the Minneapolis, Kansas City and other shows, at all of which there will be shown a complete line of the Star hand-made tires.

Daniel Zeisloft, formerly with the Marathon Tire & Rubber Co., has joined the sales force of the Star Rubber Co., Akron.

J. I. Case T. M. Co., Racine, Wis., has decided to appoint no successor to O. R. Randall, manager of the Middle Western sales division, who resigned Jan. 1 to engage in the automobile and tractor business at Atlanta, Ga., and will distribute the sales work among the remaining division managers.

George P. Sweet of Detroit, son of E. F. Sweet, assistant secretary of commerce, has been sent to Paris to arrange foreign business details for American automobile makers with the French government.

G. P. Miller, secretary and treasurer of the Hokanson Automobile Co., Madison, Wis., has been appointed general agent of the Nash Motors Co., Kenosha, Wis., for the major part of the central section of the Mississippi valley. Mr. Miller will have charge of the distribution of Jeffery cars and Jeffery Quad trucks throughout the territory.

W. H. Masten, formerly sales manager with the Moline, Ill., Plow Co., has resigned to join the sales staff of the Oakland Motor Car Co., Pontiac, Mich.

E. R. Hollender will manage the New York store of the Jennings Motor Sales Co., which has recently closed for the agency for the Hal.

La Crosse Rubber Co., La Crosse, Wis., is increasing its force of traveling salesmen to include the entire United States territory. The latest appointment is that of Henry Olmstead, Escanaba, Mich., to whom has been assigned the Nebraska and Kansas territory.

R. S. Hartzell has been appointed state representative for Ohio of the Goodyear Tire & Rubber Co., Akron. He has been manager of the Cleveland branch of the company for 4 years. F. N. Hammond succeeds Mr. Hartzell. Mr. Hammond was formerly manager of the Youngstown branch.

Richard Bacon has resigned from the sales department of the Hudson Motor Car Co., Detroit, to form a corporation to handle Chalmers cars at Minneapolis.

A. R. Griffin has been appointed production and general factory manager of the Kellogg Mfg. Co., Rochester, N. Y. He was for some years with the Studebaker Corp. and more recently with the Timken company, Detroit.

Ben Goldberg, formerly of the Brooklyn *Daily Eagle*, has joined the advertising division of the Chevrolet Motor Co.

Dealers

Willys-Overland, Ltd., West Toronto, Canada, has established a third factory branch at Winnipeg to serve forty dealers in Manitoba. The Winnipeg branch will have a floor space of 32,000 sq. ft.

H. W. Johns-Manville Co. has opened a new office in Des Moines with W. B. Roberts in charge. This makes the total number of branches fifty-five.

Fisk Rubber Co., Chicopee Falls, Mass., has purchased a site at 210-212 South Pinckney Street, Madison, Wis., for a proposed branch house in the capital city of Wisconsin to be 56 by 120 ft. in size, two stories and basement.

New York Show changes made in agencies are as follows in New York:

The Pathfinder Co. of New York has been formed to handle the Pathfinder and offices and salesroom established at 1620-24 Broadway. J. P. Hilands is president and general manager of the company.

Hal is to be handled by the Jennings Motor Sales Co., which has opened a salesroom at 1891 Broadway. It is in charge of E. R. Hollender.

Auburn will be handled by F. W. Wright, Inc. Offices and salesrooms have been located at 1793 Broadway. The company includes F. W. Wright, J. W. Gothard and W. S. Maltby.

Peerless will be handled in Brooklyn, N. Y., by the L. A. D. Motors Corp. The company will distribute in Kings and Queens counties.

Packard Motor Car Co., Detroit, Mich., has purchased property valued at $180,000 in Newark, N. J., as a site for a building to be used for the northern New Jersey headquarters.

Hood Tire Co., Watertown, Mass., has opened a factory branch in Atlanta, Ga. I. W. Hill is district sales manager of the Southeastern territory and will make his headquarters in Atlanta.

Ford Motor Co. of Milwaukee, has enjoyed an increase of 400 per cent in sales here since Aug. 1, when the new sales policy was inaugurated and the branch was discontinued.

Polack Tire & Rubber Co. will give up its Philadelphia branch at 1906 Market Street and will turn the territory over to Maxwell Smollen, its present manager.

Death & Watson, Ltd., Toronto, has become the Rosedale Motors, Ltd., and with the reorganization of the firm the company assumed the Ontario agency for the Jordan in addition to the Marmon.

Kellogg Mfg. Co., Rochester, N. Y., which manufactures engine-driven tire pumps, has opened a branch at 719 Jefferson Avenue, Toledo, with E. E. Kirk as manager.

Prest-O-Lite Co., Indianapolis, established sixteen new battery-service stations in various sections of the United States during the week ending Jan. 13.